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TREATMENT AND PREVENTION

OF

DECAY OF THE TEETH.

BY

ROBERT ARTHUR, M.D., D.D.S.

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SECOND EDITION,
WITH FIFTY ILLUSTRATIONS.

PHILADELPHIA:
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PREFACE TO SECOND EDITION.

A VERY extended application of the system of treating the teeth, explained in this work, has afforded the author ample opportunities of observing results of the practice. These have given him no reason to change the views stated in the first edition; views which were the outgrowth indeed of a careful study of this special subject, extending over a number of years, before they were offered in any form to the dental profession.

But while he is entirely satisfied of the correctness of the general principles involved in this method, he, in time, became aware of certain defects of detail which formed very serious objections to its adoption. These objections have been strongly urged, and although somewhat magnified, their force is, to a certain extent, admitted by the author.

The defects referred to have, however, been entirely obviated during the past five years. In the present edition Section X. of the first edition has been omitted, and in its place a brief statement of the modifications found advisable has been made. These modifications the author believes will be found to remove all objections to the method of any weight.

He has not thought it requisite to modify the general argument of the work, as he has met with no criticism bearing upon it which he regards as of sufficient importance to induce him to make any change in this respect.

BALTIMORE, MD., February 10th, 1879.

PREFACE.

THE author of the following work offers it as the result of a long and very careful study of the subject of which it treats; a subject relating to important interests of every individual.

What is known as "Decay" of the teeth is very common at the present day throughout the civilized world. It is believed to be more prevalent in this country than elsewhere, although there are no trustworthy data, known to the writer, for such an impression. That it is becoming more common and more destructive, is also believed by those who are best qualified to form a correct opinion on the subject.

However this may be, there is no doubt that an immense amount of suffering, mutilation, and injury to the general health results from decay of the teeth. This fact, indeed, forces itself upon the attention of every one who observes what is passing around him, even if he has had the rare good fortune to escape trouble of this nature in his own individual case. It will not admit of question, when the universal prevalence of this disorder, and the painful character of some of its features are considered, that it leads to a greater amount of physical suffering than springs from any other source.

That so much attention is given to the treatment of decay of the teeth and to the repair of the damage caused by it, is in itself sufficient evidence of the extent to which it prevails. It is estimated, no doubt correctly, that there are at least twelve thousand persons engaged in the practice of dentistry in the United States, and as many in Europe. The great object of dental surgery is, of course, the preservation of the natural teeth. Yet it cannot be denied by those who have given most attention to the matter, that it falls in this respect, when the general result is considered, far short of what it might reasonably be expected to accomplish. That this statement is true becomes apparent from several facts not generally known :

1st. In the United States alone over three millions of artificial teeth are annually manufactured and sold to supply losses of the natural teeth destroyed by decay.

2d. In most of the larger cities there are establishments devoted, exclusively, to the painless extraction of teeth, the patient being previously rendered unconscious by the use of nitrous oxide gas. In one of these establishments alone, and that not in the largest of our cities, some ten thousand teeth, the writer has been informed, are extracted annually. It would certainly not be wide of the mark to say that more than a half million teeth are extracted, annually, at these establishments. This number, however, indicates but a small fraction of the teeth extracted every year in this country: it has been estimated at twenty millions.

It must be borne in mind that, in a great many cases in which the teeth have been, finally, destroyed by decay, attempts have been made to save them.

The remedy relied upon for this purpose is what is known as "filling," or "plugging" the decayed cavities with gold. The extent to which this means of arresting decay is practiced may be surmised when the amount of material consumed is known. It is estimated that three tons of pure gold are annually consumed in this country alone in the manufacture of gold foil, and used exclusively for filling teeth; this product selling for nearly 3,000,000 of dollars. But, beside gold, a variety of other inferior materials are employed, to a very great extent. A great deal has been done in the way of perfecting this operation; and the necessary instruments and appliances for the purpose have within the past twenty years been greatly improved. So successfully have thought, labor, and ingenuity been applied in this direction, in this country, that American dentists take the first rank in the world as "operators." Even in Paris, where it might be supposed such an art would exhibit its greatest development, American dentists hold the highest position in public estimation. "*Dentiste Américain*" appears, it is said, upon the professional signs of Frenchmen who have never been upon American soil.

But the wholesale losses of teeth, to which attention has just been called, and among the sufferers are people who are anxious, and who make every possible effort, to have them saved, indicate something wrong in relation to the matter. It is certain either that the means relied upon for the arrest of decay are insufficient for the purpose, or that they are imperfectly applied.

One of the inevitable consequences of this state of things is a lack of confidence on the part of the public in the ability of dentists to preserve the natural teeth, and the questions are frequently asked:

Is dentistry, so far as it proposes to save the teeth from destruction by decay, a delusion or an imposture?

If it is efficient for this purpose, why do so many people lose their teeth, partially or entirely, after having intrusted themselves to the care of men of so much professional reputation with the public as to enable them to command confidence and to obtain large and lucrative practice?

It is proposed to show in the following work, notwithstanding the frequent failure successfully to combat the ravages of decay, as indicated:

1st. That all the teeth of every individual, with rare exceptions, may be preserved.

2d. That decay of the teeth may be *prevented* from occurring at places where it is most destructive and requires the most difficult, painful, and expensive operations for its arrest.

3d. That all the attention necessary for the certain preservation of the teeth, provided it is given in time, is of simple character, and quite within the ability of any dentist of ordinary acquirements.

4th. *That the pain usually attending dental operations may be entirely avoided.*

5th. That, as the operations required are of simple character, the cost of the preservation of the teeth will be diminished.

Disease of the general system is very often complicated and obscure. After careful study, the most intelligent physicians often find themselves greatly at fault with regard to the true nature of diseases they are called upon to treat. For this reason popular works on general medicine have met with the just condemnation of the medical profession, as calculated, in many instances, to mislead, and often to do serious injury. But decay of the teeth, from which so many serious evils result, is a very simple disorder; its nature, and the efficient means of arresting it, may be readily and clearly understood. If a little thoughtful attention on the part of the public were given to this subject, an immense amount of imposition, suffering, and irreparable injury, upon which people are rushing blindly every day, and submitting to as inevitable, might be avoided.

The object of this work is to describe a new method of treating the teeth, in such plain language that it can readily be understood by any one who will take the trouble to read it with ordinary attention, and at the same time in such detail as to enable any dentist to practice the system explained if he should be disposed to do so. As few technical terms as possible have been employed, and it will be found that those used are necessary to a clear presentation of the subject treated.

The principal reasons which have induced the author to give it, to some extent, this popular character, are to show plainly to the public at large that there are other and more efficient means of relief from a common cause of suffering than those at present relied upon, and to place in the hands of such members of the dental profession as may be disposed to adopt the method explained, a means of combating prejudices which are strong and widely spread, and which they will be sure to encounter in their attempts to put it into practice. The author trusts and believes that the facts and arguments of the work will be found ample for the object in view. He has brought the system of treatment he now proposes to explain more fully than he has yet done, on every proper occasion, in a public manner, to the attention of the dental profession; he has challenged controversy on the subject; "he has sought for objections and difficulties, instead of avoiding them, and has shut out no light which could be reflected upon it from any quarter." The subject has been more or less discussed during the past three years, and he has heard not one single objection to the general features of the system worthy of serious attention. He has a right, therefore, in view of the facts above stated, independently of the convictions resulting from a very extended experience in this direction, to confidence in the general correctness of the system proposed, however much, in its details, it may subsequently be modified and improved.

BALTIMORE, MD., September, 1871.

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TREATMENT AND PREVENTION

OF

DECAY OF THE TEETH.

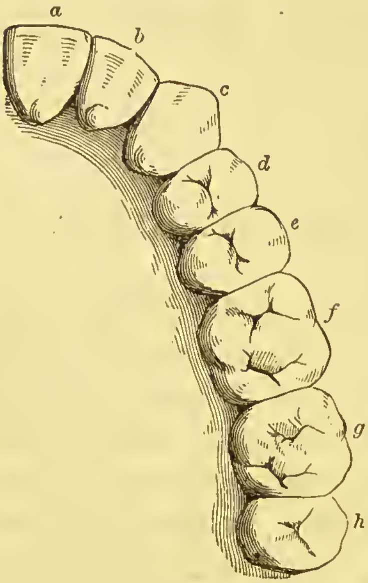
I.

THE HUMAN TEETH.—THEIR STRUCTURE.

EVERY individual is provided, during life, with two sets of natural teeth. At about the age of two years the teeth of the first or temporary set are completed. Of these there are twenty. At about the age of six years the temporary teeth begin to fall out, and, gradually, to give place to those of the permanent set, which, with the exception of the wisdom teeth, is generally completed some time before the thirteenth year. The wisdom teeth, as they are termed, usually make their appearance at from the eighteenth to the twentieth year, although there is considerable irregularity about the time of their coming. The number of teeth composing the permanent set is thirty-two.

The permanent teeth are divided into four classes. As reference must be made, in the following pages, to particular teeth, and to some of their external surfaces, it is necessary that the reader should know the names by which they are designated. The four front upper teeth (the names given to the lower correspond exactly to those of the upper jaw) are the *incisor*, or cutting teeth, two on each side, Fig. 1, *a*, *b*. Those contiguous to them, one on each side, are called the *canine* or eye teeth, *c*. The next are the *bicuspids*, *d*, *e*, of which there are two on each side. These are intermediate to the eye teeth and the *molar* or jaw teeth (as they are commonly called), of which there are three on each side, *f*, *g*, *h*. The last of these three, *h*, is the wisdom tooth, one on each side.

Fig. 1.*



The surfaces of the teeth to which most frequent

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* Fig. 1.—Permanent teeth of one-half of the upper jaw. The following is the order in which they make their appearance:

Class 1st,	*a*—Central incisor,	from	6th to	8th year.
	b—Lateral incisor,	"	7th "	9th "
" 2d,	*c*—Canine,	"	12th "	13th "
" 3d,	*d*—First bicuspid,	"	9th "	10th "
	e—Second bicuspid,	"	11th "	12th "
" 4th,	*f*—First molar,	"	6th "	7th "
	g—Second molar,	"	12th "	13th "
	h—Third molar, or wisdom tooth,	"	17th "	21st "

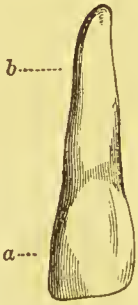
reference will be made are those in continued contact. They are known as the *proximate* surfaces, and will be so designated throughout this work. The proximate surface of each tooth, looking toward the central line of the face, is called the *mesial*, the opposite one, the *distal*. The broad surfaces of the molar and bicuspid teeth, which come in contact in the act of eating, are known as the grinding surfaces.

Some acquaintance with the structure of the teeth is necessary, in order to render intelligible any explanation of the nature of the destructive process known as "decay," to which they are so commonly subject.

That portion of a tooth which is seen, as it occupies its natural position in the mouth, is called the *crown*, Fig. 2, *a*. The part concealed by the gum is called the *root*, Fig. 2, *b*. The roots of the teeth are fixed in sockets of thin bone formed simultaneously with them, and by which they are firmly embraced.

The teeth bear a certain resemblance to the bones, but differ from them in the fact that a large portion of each tooth is exposed to contact with agents of various kinds, external to the body, while the bones are covered up by the soft tissues. They differ, also, in

FIG. 2.*



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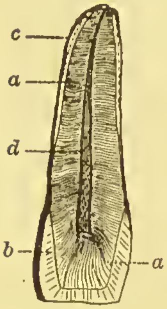
* FIG. 2.—Front view of upper incisor tooth. *a*, crown; *b*, root.

other particulars. They are composed, principally, of a substance to which the name of *dentine* has been applied, Fig. 3, *a*, *a*. The dentine of the crown is covered, completely, with a layer of enamel (Fig. 3, *b*), so called from its density, and the polished, vitreous appearance which it presents. The dentine of the root is covered with a layer resembling bone, Fig. 3, *c*, as the crown is covered with enamel. This covering of the root is termed the *cementum*.

FIG. 3.*



These three structures form the hard part of the tooth, and are composed, principally, of the same substance,—lime; but the manner in which this material is employed to make up each particular part is strikingly different.

The dentine of the fully-formed tooth is composed, in part, of a series of tubes opening from the cavity of the nerve (presently to be described), and running thence to the under surfaces of the enamel and cementum, represented by the dark lines in the dentine, Fig. 3, *a*. These tubes are separated from each other by a homogeneous, ivory-like substance. Fig. 4 is a portion of the wall of the nerve-cavity, showing the openings of the tubes of the dentine.

FIG. 4.†

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* FIG. 3.—Vertical section of same tooth. *a*, *a*, dentine; *b*, enamel; *c*, cementum; *d*, nerve-cavity.

† FIG. 4.—Transverse section of tubuli of dentine.

The enamel, Fig. 3, *b*, is composed of short, solid fibres, the ends of which, opposite to the external surface, rest upon the dentine. These fibres are united by an intermediate substance, and the external surface is smooth and polished. The enamel of the teeth is the hardest of animal structures.

It is important, in carrying out the design of this treatise, to notice the fact that, although the enamel, if perfectly formed, should entirely cover the crowns of the teeth, it is, generally, at least at the present day, in civilized communities, defective at certain points of some of the teeth. These defective places, in one of the teeth, are shown, Fig. 5, *a*. By referring to Fig. 1, it will be seen that defective places of the same kind are to be found on all the grinding surfaces of the molar and bicuspid teeth. This results from the imperfect union of the different portions of the enamel, the formation of which commences at the several most prominent points of the crown. The defects of the enamel, as shown, Fig. 6, *a*, commonly extend through to the dentine. The fissures in the enamel, represented

FIG. 5.*

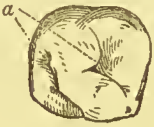
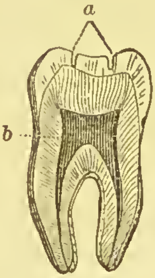


FIG. 6.†



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* FIG. 5.—Grinding surface of upper molar tooth. *a*, defects in the enamel.

† FIG. 6.—Vertical section of lower molar. *a*, defects in enamel; *b*, nerve-cavity.

in the figure, do not, however, always extend to the dentine.

The cementum is very similar in structure to bone. From true bone, both the enamel and dentine differ very materially. A characteristic feature of bone is, that it contains irregularly-shaped cells at intervals,—these cells being connected with each other by means of minute canals.

The "nerve" of a tooth, as it is popularly called, is the remaining portion of the pulp, by means of which the dentine is formed. As the forming tooth goes on towards completion, this pulp, originally the full size and shape of the future tooth, gradually diminishes until it occupies a comparatively small part of the crown. It is contained, in the fully-formed tooth, in a cavity in the centre, Fig. 3, *d;* Fig. 6, *b*.

This pulp is not merely a nerve, as is popularly supposed, but is a body composed of all the elements of any vital tissue. From this central pulp nerves and vessels, capable of carrying nutriment to all parts of the dentine, pass out, on all sides, through the tubes which have been described. The pulp is connected, in the fully-formed tooth, with the great centres of life by means of a cord, so minute that the canal, through which it passes into the root, can scarcely be seen with the naked eye where it commences; and yet this hair-like cord contains an artery, a vein, nerves, and the other organs necessary to the vitality of any part of the body. Through this minute cord blood is thrown at every impulse of the heart, and it is partly made up of sensitive nerves in direct connection with the nervous centres, by means of which sensations are conveyed from every part of the dentine. But the fibrils passing from the pulp, into the tubes of the dentine, and capable of performing the same vital functions as the pulp itself, are so minute that the tubes, into which they pass, can only be discovered by a microscope of high power. The largest are not more than the one ten-thousandth of an inch in diameter. It is by means of these minute fibrils that the life of the dentine is maintained. This vital property of the dentine, as will be shown hereafter, has a very important bearing upon the progress and treatment of decay of the teeth.

But the pulp, or "nerve," is not the only source from which a tooth derives its vitality. The root is covered by a membrane, well supplied with nerves and blood-vessels, which pass into the cementum. It is by means of this membrane that the vitality of the exterior of the root is preserved, even after the nerve is dead. Although in such case the whole of the tooth, dependent upon the nerve for vitality is dead, yet, by means of the remaining vitality of the root, it may remain, for many years, in its position in the mouth in a comparatively healthy state. It is an inflamed condition of this membrane, and another lining the socket, which gives rise to pain, of a very severe character, after the nerve is entirely dead. The character of the pain, occurring in this way, so nearly resembles ordinary toothache, which results from exposure of the nerve, that it is frequently mistaken for it, and, for this reason, the question is often asked : Is it not strange that a tooth should ache after the nerve is dead ?

Frequent mention must be made in the following pages of the fluid contents of the mouth. These are called secretions. This word secretion has a technical signification. It does not mean, in its verbal form, the hiding away of anything, but the "separation" of some constituent of the blood : as the gastric fluid, secreted by the stomach ; the bile, by the liver, etc. The principal secretions of the mouth are the saliva and the mucus. The former is secreted in large quantity by several glands situated near the mouth ; the latter, by the membrane which covers the whole of the interior of the mouth, and which is known as its mucous membrane.

II.

DECAY OF THE TEETH.

AS soon as the teeth make their appearance through the gums they are subject to a process of decomposition, by which they are more or less rapidly and entirely destroyed, unless some means are employed to arrest its progress. This progressive decomposition of the teeth is commonly known as "decay." The teeth of all persons do not inevitably decay, but, in this country, at the present time, those of very few are exempt from its attacks. A physician of Baltimore, Maryland,* interested in the subject, made examinations of the teeth of one hundred and seventy-five persons, of all conditions in life, and out of this number found but two individuals whose teeth were free from decay.

A great deal of attention has been given to the subject, and decay of the teeth has been attributed to a variety of causes, but, so far as its treatment is concerned, its nature is easily comprehended.

It has been stated that the hard part of the teeth consists principally of lime. This substance, as is well known, is decomposed when certain acids are brought into contact with it. A striking illustration of the effect of an acid upon a body composed principally of lime is to be found in the familiar experiment of immersing an egg in vinegar. When this is done, the lime, which gives density to the shell, is, in a short time, dissolved out, leaving the contents of the egg inclosed in a tough membrane, composed of animal matter, not liable to be affected by so dilute an acid.

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* Professor H. R. Noel, of the Baltimore College of Dental Surgery.

It is found that when a tooth, out of the mouth, is exposed, for a certain time, to the action of a dilute acid, the lime, which enters so largely into its composition, is entirely removed. The acid leaves no trace of the enamel, under such circumstances, but the animal matter, which forms a large part of the dentine and cementum, remains, and retains the form of the tooth treated in the manner described.

The two experiments noticed render it obvious that the largest constituent of a tooth is liable to be decomposed by the action of an acid. The question now comes: Is such an agent present in the mouth, and do the phenomena of decay justify the conclusion that it is attributable to the action of this agent?

It has been found, by careful examination, that the two principal secretions of the mouth which, in a state of perfect health, exhibit an alkaline reaction, are commonly so acid in character that this condition may be readily detected by well-known tests. This is the unvarying testimony of every one who has investigated the subject. Besides this condition of these secretions, due to some abnormal condition of the body, various substances are taken into the mouth which are either acid in themselves, or undergo changes in the mouth which render them acid. Animal substances, according to Liebig, generate lactic acid when retained in the mouth for some time, and this acid acts very energetically upon phosphate of lime.* We have, then, all the elements to account for the decomposition of the teeth. But if they are constantly in contact with a fluid more or less acid in character, the natural result to be looked for would be their general decomposition in a manner similar to what occurs when an extracted tooth is immersed in dilute acid. This, however, does not take place. Decay of the teeth is not a uniform decomposition of their surfaces. The destructive process is seen to begin at a particular spot, sometimes more than one, from which it extends in every direction, but more rapidly toward the nerve. Not only is the lime of the dentine decomposed, but also the animal matter, which does not occur, as already stated, as a consequence of the immersion of the extracted tooth in dilute acid. These points of difference may be readily explained.

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* To avoid cavil, I would here say that I cannot undertake to be strictly accurate, or very minute, in the explanations I make; as I am writing for general readers, as well as for dentists, I must be content with general statements which are substantially correct.

It has been supposed that the principal source of the acid by which decay is produced is to be found in the mucus secretion of the mouth. Late physiologists state that the mucus, as well as the saliva, is alkaline in its reaction. But it is admitted that in certain deranged states of health, or in the general physical condition which may be considered somewhat abnormal, of most individuals in civilized communities, at the present day, both secretions are, frequently, so changed from their true character as to become acid in their reactions. It has been supposed that the mucus secretion is more liable to become changed, in the way intimated, than the saliva. It has, indeed, been stated by Tomes and others, that it is acid, as a general rule, in ordinary states of health. However this may be, it is obvious that, as a consequence of its viscid character (and it is observed that in the mouths of persons very subject to decay of the teeth it becomes excessively so), it attaches itself to certain parts of the teeth, from which it is difficult to remove, and is liable to remain in such positions for an indefinite time. If it be true that this secretion exercises a more destructive influence upon the teeth than the saliva, it may be partly accounted for in this way. It is certain that the lower incisor teeth, which are continually bathed in the saliva, and which are free from defects in the enamel, are but little subject to decay; while the upper incisor teeth, to which the mucus may be expected to attach itself, at positions not readily accessible, are commonly destroyed by it, unless some means are taken to stop its progress.

As stated, too, the fragments of certain kinds of aliments, retained for a time in the mouth, as may be by being lodged between the teeth, where they are in close contact, or in defective places, generate an acid. Even where fragments of food do not undergo this change, they serve to assist in retaining the acid secretions of the mouth in contact with certain parts of the surfaces of the teeth.

Whatever may be the source of the agent causing decay, the disorder is always observed to commence at points which favor the lodgment and retention of particles of food, or the secretions of the mouth.

This, then, is a sufficient explanation of the nature of decay of the teeth for the purposes of this treatise. The teeth are made up of a substance of such nature that it is decomposed by acids, which either exist, are taken into, or are formed in the mouth, but are so feeble in power as to act slowly, and therefore require to be retained, for some time, in contact with them to produce the effect which is called decay.

Whenever, therefore, a defect in the continuity of the enamel of a tooth exists, as shown in Figs.

5 and 6, decay is sure to occur. To this rule there are very rare exceptions. It is not necessary that the defect should extend through the enamel. Decay commences at the defective point. As it progresses, the affected spot grows into a cavity; the destructive agents now find a larger surface to act upon, and, coming into contact with the whole interior of the cavity, the decay goes on with steadily accelerating rapidity, until, in most cases, the crown of the affected tooth is destroyed, unless some means are employed to arrest its progress.

The perfectly-formed portion of the enamel on the grinding surfaces of the teeth, surrounding the defective places noticed, is not liable to decay, as it is kept cleansed by the act of mastication itself. It is, however, decomposed before the dentine is reached, in case the defect does not extend through the enamel, and after a cavity of decay is formed, by decomposition from the interior surface. Slight observation shows, that on the exposed surfaces of the teeth decay occurs at those points, only, where the enamel is defective. It is quite a natural inference, therefore, as decay appears to occur at those points, only, where there is an opening through, or a defect in, the enamel, and does not affect a perfect and smooth surface, so far as common observation goes, that the enamel resists the action of the solvent producing decay. It may also be inferred, as decay occurs, apparently, only where the enamel is defective, that if it should be removed, decay will attack the dentine. It is, indeed, popularly believed that the enamel is intended to protect the teeth from decay, and that one of the most certain consequences of its removal is the rapid destruction, by this disorder, of a tooth deprived of its protection. This belief, as widely spread as it is, both in and out of the dental profession, is a fallacy. It is so obvious a fallacy, indeed, that it is surprising that it should ever have been entertained by any dentist, who had given himself the trouble to notice what daily offers itself even to very careless observation.

It is stated in Harris' "Principles and Practice of Dentistry" that decay commences in the dentine, underneath the enamel, where the latter is imperfect, and does not attack the enamel where it is perfectly formed. This is an error. Decay, as I will show, frequently commences on surfaces covered with perfectly-formed enamel, at points where it is entirely uninjured. Tomes states that both the enamel and dentine are subject to decay. The fact is that the enamel is composed of very nearly the same organic constituents as the dentine. The difference between the two substances consists in the larger proportion of animal matter in the dentine, of which there is a mere trace in the enamel, and in the different arrangement of the materials of which the two substances are made up. This has already been noticed. Both the enamel and dentine, therefore, being composed, principally, of phosphate of lime, are decomposed when exposed, under certain circumstances, to the action of such acid agents as are generally present in the mouth.

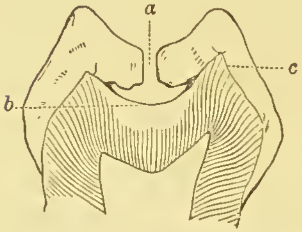
It was stated that while the whole of the hard part of an extracted tooth, immersed in dilute acid, was decomposed, the animal matter remained unaffected. In decay this does not appear to be the case, as both tissues seem to be simultaneously decomposed. This is apparent only, however; the lime is first dissolved out by the acid agent, and the animal matter, subsequently, decomposed by other agencies, and removed from the cavity.

It is certainly true that the enamel, being, if well formed, much more compact than the dentine, is not so readily acted upon by a dilute acid *under the same circumstances*, as the more compact a body is the less surface it presents to the action of a solvent. But this very compactness of the enamel, so well fitting it for the attrition to which, in the performances of its uses, it is subjected, and in some measure rendering it less liable to be decomposed, necessarily deprives it of vitality. The dentine is less dense than the enamel because there is in it a larger proportion of animal matter. This, as has already been explained, consists principally of the fibrillæ which occupy the tubuli, although animal matter enters into the composition of the intertubular tissue. When, therefore, the enamel is attacked by decay, it has no power of resistance.

This is not the case with the dentine. Instead of being necessarily, and helplessly, destroyed when attacked by decay, it possesses the power (not generally known) of making an effort to protect itself from destruction. This is a point of importance, and, I trust, when fully understood, will tend to remove the injurious error, so generally prevalent, with regard to the destructible nature of this part of the teeth as compared with the enamel.

It has been explained that the dentine consists, in part, in each tooth, of minute tubes, opening from the nerve-cavity and running to the enamel, and that through these tubes pass very small fibrils, coming off from the nerve, and endowed with all the essential elements of vital tissue. It is by this means that all those parts of the teeth uncovered by the gum, except the enamel, are living parts of the body. The dentine, indeed, exhibits most, if not all, the essential attributes of vitality. This cannot be questioned, when its extreme sensibility, and the obvious physical changes which occur in it, are considered. Mr. Tomes, who is recognized as one of the ablest special physiologists now living, has made some very important discoveries in regard to the dentine, both in a state of health and disease. It was formerly supposed that the tubuli of the dentine contained a nutritive fluid merely, furnished by the "nerve," and circulating through them. But Mr. Tomes demonstrated, by means of the microscope, the existence of distinct fibrillæ, passing off from the nerve into the tubuli, and running through them to the junction of the dentine and enamel. He explained, satisfactorily, for the first time, the true character of the change which takes place in the dentine in the effort sometimes made by nature for the arrest of decay. He established the fact that between the decaying portion and the nerve a barrier is set up against the progress of the attack of decay. A remarkable change takes place in the fibrillæ of the tubuli toward the portion of dentine attacked by decay. They are, indeed, obliterated, and the tubes are filled with a dense ivory-like substance. The change referred to was illustrated by a drawing from a microscopic preparation by Mr. Tomes, and is clearly shown in several sections of slightly decayed teeth in my possession. One of these is represented in Fig. 7. In this case the decay had commenced at a defective point in the enamel, *a*. It will be seen that it has extended, laterally, underneath the enamel, but that the tubuli of the upper surface have evidently been obliterated by the process re-

FIG. 7.*



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* FIG. 7.—Vertical section of decayed molar magnified. *a*, fissure in enamel; *b*, tubuli obliterated by calcification of fibrillæ; *c*, tubuli unaffected by decay.

ferred to, *b*. It will also be seen that the tubes, in their normal condition, run fully up to the enamel on each side of the part affected by decay, *c*.

It is probable that this change always occurs when decay attacks the dentine, if the latter is well formed. In such cases, even where the conditions are favorable to the production of decay, its progress is very slow. Sometimes it is quite evident that decay has slowly progressed during the greater part of a lifetime without destroying the affected teeth. In many cases it is completely arrested. But when the structure of the teeth is imperfect, and the secretions of the mouth are very corrosive, as is so common at the present day, this effort of nature proves, except where circumstances favor the result, ineffectual, even to materially retard its progress.

The action referred to is curiously exemplified in the first permanent molar teeth. When they first attain to their full size, apparently, the roots are not completed, and the pulps are furnished with a large quantity of blood destined for this purpose. The formative power is at that time of life very active. The formation of the dentine, on the interior of the roots, is progressing rapidly, and under the influence of irritation of any kind, one of the natural functions of the pulp or "nerve," that of depositing the particles of lime, of which the hard part of the teeth is composed, is stimulated. It not unfrequently happens that when decay commences in the dentine at one of the fissures in the defectively formed enamel, the process referred to immediately commences, and a barrier to the progress of the decay is set up, as shown in Fig. 7. Even after the teeth are fully formed, some change of this kind, no doubt, occurs generally; but the solvent, acting upon the dentine, is too powerful, and this changed dentine is decomposed in turn. But in many cases the effort is effectual, and the decay is checked, as it extends along the most superficial layer of the dentine, underneath the enamel, but does not make any progress below the surface. In the case, referred to, of the first permanent molar, the enamel of the grinding surface is, in consequence of decomposition from the interior of the cavity, completely destroyed. It has no power of resistance, being entirely devoid of vitality, while the dentine protects itself. The surface of the dentine, which has undergone the alteration described, is darker in color, and is, generally, mistaken for decay; but so far from being affected in this way, it is really no longer liable to decay, except under very unfavorable circumstances. A tooth which has undergone this change will, usually, remain free from decay during life.

The curious fact here presents itself, in the face of the popular belief that the enamel protects the dentine from decay, that it is destroyed, while the dentine which, it is supposed, is certain to be destroyed, if deprived of enamel, effectually protects itself.

As life advances, the grinding surfaces of the teeth are very commonly worn away, sometimes down to a level with the gum, by the friction occasioned by substances undergoing mastication. In such cases the enamel is, of course, first destroyed on the wearing surfaces, and the dentine becomes exposed; yet such teeth rarely decay. On the contrary, the fibrillæ of the tubuli undergo the change described as rapidly as the surface of the dentine is worn down. The "nerve" itself, indeed, instead of becoming exposed by the wearing away of its protective covering of dentine, becomes changed, as it is approached, into a substance denser, in structure, than the dentine itself, unless the destruction of the dentine by friction progresses more rapidly than the protective process, and the "nerve" becomes exposed.

From the statements made, the truth of which cannot be denied, of the characteristics of the principal constituents of the teeth, the enamel and dentine, it is apparent that both are liable to decay. It cannot be questioned, as already stated, that well-formed enamel is denser, and better capable of resisting attacks of decay, under similar circumstances, than the dentine, but that the latter, when attacked, is endowed with a power of self-protection which the enamel does not possess. I will show, hereafter, that the property of the dentine described, is a most important element in the treatment of decay of the teeth.

The hard, flinty, character of the enamel was evidently intended to subserve the mechanical uses of the teeth. It is eminently fitted, therefore, to bear the friction to which it is constantly subjected, but that it has no capability of resisting attacks of decay, under favoring circumstances, has already been noted by one of the ablest writers on the subject of the comparative anatomy of the teeth. In describing the structure of the enamel, he states that it reaches its highest condition of development in the mammalia, but goes on to say: "This condition of the enamel, however, like the corresponding one of the mammalian dentine, in the same degree as it distinguishes them from the true osseous tissue, and perfects them for their mechanical applications, removes them from the influence of the conservative and reparative powers of the living organism. The mammalian enamel, therefore, once formed and exposed, *is least able to resist, vitally, the influence of external decomposing forces;* but this inferiority is amply compensated by its superior mechanical endowments."*—*Owen's Odontography*, Introduction, xxiii.

It is certain that, at the present day, it does not furnish any obstacle to the occurrence of decay of the teeth. This is obvious from the fact that decay occurs more frequently at points where the enamel covers the dentine, completely, than where defects exist in it. The defective points on the grinding surfaces of the molar teeth have been shown. Decay is certain to occur at these points in most cases. But on all the other surfaces of the teeth, toward the lips and cheeks, and the inside of the mouth, and where they are in contact with each other, the enamel is originally formed without a fissure. Is it necessary to say that decay occurs where the teeth are in contact? How rarely are the incisor teeth of women, at the present day, perfectly sound at the points referred to. They are either preserved by fillings on the proximate surfaces, or have been entirely destroyed. And yet, in all such cases, decay must have commenced at points where the teeth were completely covered with enamel. So with the bicuspid and molar teeth. Few persons reach adult age and escape decay of the proximate surfaces of these teeth. Very few adults have all their permanent teeth, and yet, among the better classes of people, the decay by which those lost have been destroyed, commenced, not in the defective places of the crowns of the teeth (as, if any attention has been

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* It may be said that Mr. Owen makes no distinction between the enamel and the dentine as compared with the bones; but the point he makes is, that in proportion to the vitality of a part is its power to resist the action of external decomposing agents. It

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follows, therefore, that the dentine is endowed with a power of resisting the action of solvents which produce decay that the enamel does not possess.

given to them, these places are usually filled), but at points where the enamel was originally perfectly formed. In looking over my records of cases treated, I have taken one hundred consecutively, and, therefore, without selection, and found that decay had occurred at 402 places where the enamel was defectively formed, on the grinding surfaces of the molar and bicuspid teeth, and in 1153 places where the enamel had been originally perfect on the proximate surfaces of the teeth.

Mr. Tomes, already referred to, furnishes, in one of his works, a series of interesting tables, made up from records of cases of extraction of teeth during his service at a London hospital, showing, among other features, the points at which decay occurred. From these it appears that out of 1719 teeth extracted, decay had occurred at 995 places where the enamel may be presumed to have been perfectly formed originally. In the bicuspid teeth the remarkable disparity is shown of 349 teeth extracted for decay on the surfaces, in contact, where the enamel was originally perfect, and but 27 places in which it occurred at the defective points on the grinding surfaces. These are instructive facts, and should be carefully considered by persons, both in and out of the dental profession, who are under the impression that the enamel protects the teeth from decay.

III.

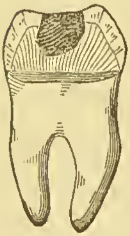
TREATMENT OF DECAY.

IT has been explained that decay does not usually attack the teeth except at such places as favor the lodgment and retention of particles of food or the secretions of the mouth. On the broad grinding surfaces of the molar and bicuspid teeth, or the cutting edges of the incisor teeth, decay would never take place, provided the enamel on these surfaces were well and smoothly formed. Nor does decay, except in very rare instances, attack the smooth surfaces of any of the teeth toward the lips, cheeks, or tongue. The act of mastication, the almost constant movements of the tongue and lips, and the copious flow of the saliva, tend to keep the more prominent parts of these surfaces free from extraneous deposits of any kind. But the enamel of the grinding surfaces of the teeth, as has been explained, is very rarely perfectly formed. Defective places remain in some parts of this covering of the dentine almost invariably. At these places, as already explained, decay is very nearly certain to occur.

Now, it is obvious that if these defective places could be obliterated, by being filled up with some substance capable of resisting the action of such decomposing agents as are present in the mouth, decay could not occur; or if it had made an attack and decomposed the dentine or enamel about these small defective places, so as to form cavities which would still further favor the retention of the destructive agents, if the cavities were filled up with a substance of the nature referred to, the decay would be arrested.

If decay occurs in the fissures represented in Fig. 6, a cavity will gradually be formed. It is evident from the nature of decay, as it has been explained, that it will continue to progress until the affected tooth is destroyed unless some means are taken to arrest its progress. The means relied upon for this purpose are to remove the decomposed dentine from the cavity, make smooth the irregular outline of the orifice, and fill it up, flush with the surface of the tooth, with some substance not affected by the fluids of the mouth, as represented in Fig. 8. Pure gold, beaten into thin sheets, is most relied upon to accomplish the object in view. The gold is put into the cavity in pieces of convenient size until it is filled, and is condensed by pressure during the process of filling, so as to be rendered capable of retaining its position indefinitely, and of resisting any amount of friction or force to which

FIG. 8.*



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* Section of crown of lower molar through the gold filling.

it can be subjected. I need scarcely say that the process briefly described is known as "filling," or plugging the teeth. The object, as is quite apparent, is merely to restore the broken continuity of the affected surface by filling up the cavities which furnish receptacles for substances that act as solvents. Decay occurring at defective places in the enamel can be arrested, generally, by filling alone; but in these cases the operations are very simple, and are rarely attended with pain if the cavities are filled at an early stage of the decay.

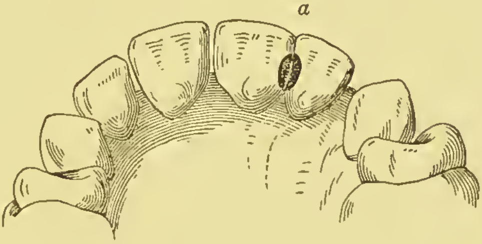
But, as has been explained, the attack of decay is not confined to the defective places in the grinding surfaces of the teeth. It occurs at places where the enamel is apparently perfectly formed upon the surfaces in contact. When decay attacks these surfaces, as will be more fully explained in a subsequent section, it usually progresses for a considerable time before it is discovered or suspected to be present. The operation of "filling" the cavities of decay then becomes difficult, is generally attended with pain of very excruciating character, and is frequently doubtful in result.

Now, it must be remembered that at the present day this operation of filling or plugging cavities of decay is generally recognized as the only means of arresting decay. During the past twenty years the whole energies of the dental profession, so far as the preservation of the teeth is concerned, appear to have been turned in this direction. An immense amount of thought, labor, and ingenuity has been expended upon the improvements of material, instruments, appliances, and methods of using gold for filling teeth. Very great advances have been made, an entire revolution in the methods of using gold has taken place, and results have been obtained, the beauty and perfection of which were not dreamed of twenty years ago. So exclusively has the improvement of this means of treating decay occupied the attention of dentists, that they appear to have lost sight of any other remedies, or have come to regard them as of comparatively little consequence.

In the introduction to the last edition of "Harris' Principles and Practice of Dentistry," an attempt is made to furnish a new classification of the "Art of Dentistry." In this classification no place is given to any other remedy for decay than one which 'contemplates the replacement of the structure of the affected teeth which has been decomposed and removed. In simpler language, filling or plugging the teeth is the only remedy for decay recognized by an authority which is supposed to represent the latest advances in the science and art of dentistry. In the body of the work, it is true, some pages are devoted to the treatment of decay by "filing," but without the addition of anything new since the publication of the second edition of this work in 1845.

But is this the only remedy? It is evident that if decay results from close contact of the teeth, it would not occur if they stood apart from each other. Fig. 9 represents a case which recently came under my notice. It will be seen that the front teeth, with the exception of the left central and lateral incisors, stand somewhat separated from each other. The latter were in close contact. The patient is over twenty years of age. All the contiguous surfaces of the incisor and canine teeth, except those referred to, Fig. 9, *a*, are perfectly sound. The latter were attacked by decay soon after they were formed, and when discovered, it had progressed so far as to render filling necessary. It is obvious, in view of the nature and causes of decay, that in this case the exemption of the teeth which remain sound is due entirely to the fact that their proximate surfaces are not in contact. If, by any means, the teeth, as they are developed, could be managed so as when fully formed to stand separated from each other, decay of the proximate surfaces would be rare. Attempts, for many years past, have been made to accomplish this object by the extraction of some of the permanent teeth at an early age, even when perfectly sound, in order to give room to those that remained,

FIG. 9.



so that they might fall away from contact with each other by changing their positions. This idea has been made the basis of a very common practice. If the plan could be relied upon, it would be a very excellent one; but, as I shall hereafter show, it fails to accomplish the proposed object, except to a limited extent, and very commonly results in evils which much more than counterbalance any advantages derived, in some cases, from it. In the very case represented by Fig. 9, four sound teeth had been extracted when the patient was a child for the accomplishment of this object; but all the remaining teeth, except the incisors, which occupied, naturally, the positions shown, came again in close contact, and decayed at all the usual places where they touched.

As there are no means at present known to dentists of managing the development of the teeth so that they can be made to stand in the open order of the case cited, the question naturally comes up as to whether such separations may not be made artificially after these teeth are fully formed. This, indeed, can be, and has been, done for many years. One of the operations relied upon by the older dentists for the arrest of slight decay was that of filing the teeth, so as to make permanent separations. But such treatment leads at once to the inquiry as to whether, in consequence of the removal of the enamel from the surfaces treated, the exposed dentine, deprived of its protection, will not be attacked by decay. The answer is generally in the affirmative, and it is the common belief; but it is as great a mistake to suppose that the dentine, when deprived of enamel, inevitably decays, as it is that the enamel protects the teeth from decay. It is evident, from the facts to which I have, in the last section, called attention, that the enamel, no matter how perfectly it may be formed, is entirely inefficient for the prevention of decay.

The vital property of dentine, by means of which it is endowed with a certain power of self-protection, has been explained. In some instances, as has been shown, decay, when it reaches the dentine, is completely stopped in the manner described, although the enamel of the same tooth is entirely destroyed.

There is no doubt that in all cases of decay this effort, on the part of nature, to stop its progress is made. There is but little question that, under favorable circumstances, decay would always be arrested in this way. It is, probably, generally retarded, but the formation of a cavity, as a necessary result of decay, furnishes so favorable a place for the lodgment of the decomposing agent, which is steadily retained in contact with the whole interior of the cavity, that its continued progress is inevitable. The entire destruction of the affected teeth is a mere matter of time unless the conditions referred to are changed.

There is abundant reason for believing that an exposed surface of the dentine from which the enamel has been cut away, provided it can be kept perfectly cleansed, undergoes the conservative alteration described. The contents of the exposed tubuli become changed into a hard ivory-like substance, and it is quite probable that in the intertubular substance there is an exchange of particles of lime for animal matter. The new formation differs from the normal dentine in being always denser and generally slightly or considerably discolored. It has been termed "eburnated," from the ivory-like character, in the consistency at least, of its surface. It can readily be detected by any one who has once examined it.

Filing the teeth for the removal of slight decay has been practiced for a great many years. I presume that no dentist, whose opinion is worthy of attention, would undertake to say that it cannot be perfectly arrested by its removal, with the observance of certain conditions, which will be explained hereafter, although the whole of the surface so treated is deprived of enamel.

There are some old persons now living in the city of Baltimore whose teeth were filed by Dr. H. H. Hayden* many years ago, and yet remain entirely free from decay. Fig. 10 represents one of these cases. It is from a model of the teeth of a lady seventy-six years of age. The teeth were filed when she was only twelve years old. After the lapse of sixty-four years, they were examined and the model made. The filed surfaces were free from any trace of decay. It is obvious that the teeth filed (the central and lateral incisors of both sides) must have been considerably decayed, as they are nearly one-third filed away.* This is but one of a number of similar cases which have come under my own notice.

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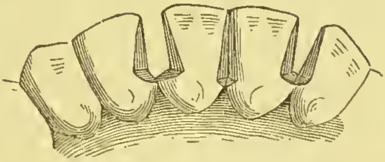
* Dr. Horace H. Hayden commenced the practice of dentistry in the city of Baltimore in 1804, and continued to devote himself to this pursuit up to the time of his death, which occurred in 1843. Dr. H. gave a great deal of thoughtful attention to the profession he had adopted. He was not slow in comprehending the advan-

FIG. 10.



The common method of treating decay of the proximate surfaces of the teeth when "filling" is

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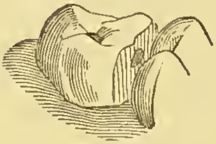
tages of the early treatment of decay in the manner described, although his operations of this description were confined principally to the incisor teeth. He was a man of unusual ability, and the benefits derived from his services, rendered many years ago, are enjoyed by persons still living. His memory deserves, and has indeed received, more than this passing tribute. It were well for the community and the dental profession if the better features of his practice had been imitated by his successors.

* Such excessive filing in a case of this nature is never necessary or allowable. As the decay had progressed so far that the forms of the teeth could not be otherwise preserved, the teeth should have been filled with gold. In attention to the front teeth, the first object of treatment is to preserve them; the next, with the very smallest possible amount of disfiguration.

necessary, is to obtain the space for the required operations by filing or otherwise cutting away the surfaces. This renders necessary the removal of the whole of the enamel of the surfaces treated. In many such cases the gold filling occupies but a small part of surface, Fig. 11. Such operations have been performed a countless number of times, and yet decay never, or with extreme rarity, recurs in the exposed dentine surrounding the filling unless it is due to other causes than the mere exposure of the dentine. If decay does recur, it commences at some part of the junction of the filling with the orifice of the cavity.

FIG. 11.



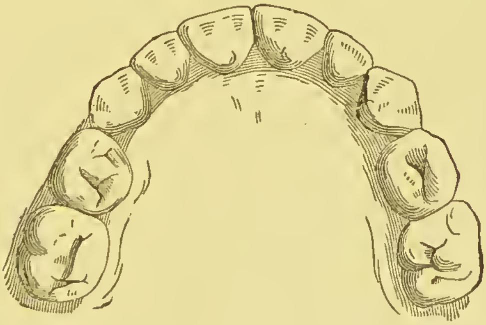
It has now been shown, I presume to say, beyond dispute, that the prevailing impression that if the enamel is removed from any part of a tooth the exposed dentine will inevitably be destroyed by decay is not correct.

The facts presented, when the structure of the teeth and the destructive influences to which they are exposed are considered, make it plain that the process of filling cavities produced by decay is not the only remedy for this disorder. I shall make it clear, I trust, that it is not only not the exclusive remedy for decay of the teeth, but that it is greatly inferior to one which looks to the arrest of decay in its incipient stage before the operation of filling becomes necessary.

I now propose to describe so explicitly and clearly as to be understood by any attentive reader a method of treatment, by means of which the whole of the attention required for the preservation of the teeth is rendered much more simple than the one almost universally relied upon. In order to render the description plain to the general reader it will be necessary to enter into considerable detail. This, however, I trust, will not be found uninteresting to any person of intelligence. Certainly no parents, who desire the welfare of their children, can find it too much trouble to consider carefully any suggestions which give promise of saving them from the terrible suffering and serious injury so commonly resulting from decay of the teeth.

At about two years of age the temporary set of teeth is completed, Fig. 12. At about the age of seven years the process of shedding commences. The roots of the temporary teeth are gradually

FIG. 12.



absorbed, and if nothing occurs to interfere with the process, the crowns of these teeth will, one after another, become loose and drop out at the period of life fixed by nature. Shortly afterward their places are taken by the corresponding permanent teeth, destined for use during life. The process of shedding is not usually completed until about the thirteenth year,—occupying some six years.

Even if no attempt has been made to preserve the temporary teeth, the regular systematic treatment of the permanent teeth should now commence, and be rigidly carried out, as this period is a critical one in regard to the subsequent condition of the permanent teeth. Their management during this short period of time determines their condition for life. They may be a source of comfort and satisfaction, or they may become a daily cause of discomfort, and so far from subserving their important uses, produce disordered conditions of the general system of such grave character as in more cases than is suspected to lead to premature death.

It will be seen by reference to Fig. 12, in which the temporary teeth of the upper jaw are shown, that they are twenty in number. These are all the teeth that are shed; those which come subsequently, either in their places, or back of them, are permanent teeth.

I have called the period occupied by the shedding of the teeth a critical one. It is well understood that a great deal may be done for the preservation of the teeth by personal care. This is obvious, indeed, from the explanation given of the nature of decay. The most scrupulous attention to the cleanliness of the teeth should be exacted from the child. But this attention, in the degree required, cannot generally be relied upon. It is of the first importance, therefore, that the child should, at this time, be submitted to the professional care of a dentist. By a dentist, I mean not a mere extractor and "plugger" or inserter of teeth, or even what is called a "splendid operator," I mean a man who has not only been thoroughly educated and trained in all the requirements of an important profession, but who fulfills them in each case with an earnest purpose; who looks not merely for the return, in money, he may obtain, but, while demanding just and full compensation for his services, keeps always in view the good of those who come under his professional care. Such a man will feel it to be his duty to impress upon persons who are anxious for the preservation of the teeth of their children, that they should be intrusted for this purpose entirely to his care and direction. He should, when he undertakes the requisite attention (which must begin as soon as the process of shedding commences), fix, after every operation and examination, the time when he considers it necessary to see the child under his care again, whether it be after the lapse of one day or one year. This must not be left to the recollection of any other person; he should send notice when the time for further examination or treatment has arrived. If the child is not sent, as he desires, unless the failure to do so is to be attributed to unavoidable circumstances, he should relinquish the case or make it plain that he will be in no way responsible for the result.

It is absolutely necessary that this rigid course should be pursued in order to carry out efficiently the plan of treatment I propose. It is, indeed, essential to the thorough practice of dentistry, no matter what plan is pursued. The common loose method pursued, of throwing the task of recollecting, with a thousand other matters to drive it out of mind, the condition of their children's teeth upon parents, always results in trouble. It is a very easy matter for a dentist to carry out a system of this kind, and the sooner he gets rid of people who will not respond to this effort for the good of their children the better. Their places will in good time be supplied by those for whom he will find it a pleasure to render service, the value of which is appreciated, and which he can make thoroughly effective.

The temporary are quite as liable to decay as the permanent teeth, and the question is often asked, whether, in view of the fact that they must eventually be lost, it is at all important, or desirable, that any effort should be made to preserve them.

There are several important reasons why all that can possibly be done in this way should be attempted:

1st. To prevent the severe suffering to which little children are generally subject as a result of the decay of their teeth.

2d. To avoid the injury to the general health, which, in some degree, inevitably results from the diseased condition into which the temporary teeth commonly fall if they receive no attention.

3d. To prevent irregularities of the permanent teeth, sometimes caused by the premature extraction of the temporary teeth.

There are other reasons why they should receive all the attention necessary to save them from destruction by decay, but these are quite sufficient. It is, of course, difficult, and often impossible, to induce young children to come into such close contact with a stranger as to enable the requisite operations to be performed. But the advantages of giving to the temporary teeth such attention as will preserve them until they are shed are so very great that it should be attempted whenever it seems to be feasible.

IV.

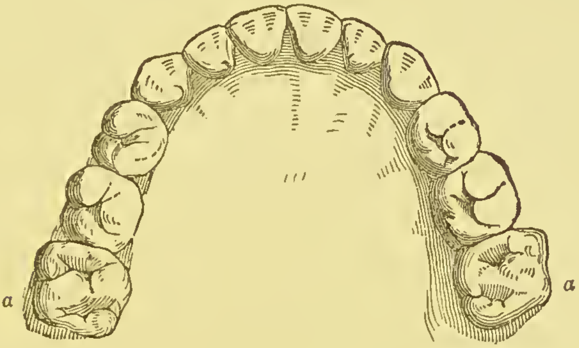
THE FIRST PERMANENT MOLARS.

IN regard to the treatment of decay of the teeth, it is most important, as I have already urged, that it should be commenced as soon as possible after the attack occurs. This is so for obvious reasons, even if the operation of filling is relied upon; but if it is proposed to take advantage of the very greatly preferable means of arresting decay by its removal in the manner I have described, it is equally obvious that it is necessary that it should be treated in the incipient stage of the attack.

The management of the permanent teeth should, therefore, commence as soon as the process of shedding begins to take place, and should be rigidly followed up as the permanent teeth make their appearance. Having explained, in a general way, the nature of decay, and the means to be employed for its arrest, I now proceed to describe, in detail, the treatment, or management, of the teeth as I conduct it in every case of which I have entire control.

Somewhat before, or about the time, the central incisors are shed, four new teeth make their appearance back of the temporary set. Two of these are shown, Fig. 13, *a*, *a*. It will be seen that they are larger than those of the same class of the temporary set; they are, indeed, larger than any of the other teeth. These teeth are known as the first permanent molars. It is a prevailing impression that the four teeth referred to, coming as they do at such an early age, about the seventh year, belong to the first set and will be shed with them. They are, consequently, generally neglected, and before it is supposed necessary to consult a dentist about the teeth of a child they are, commonly, so much decayed that their preservation is impossible.

FIG. 13.*



From what has been said of the nature of decay, it will be inferred that it is quite certain to attack these teeth at the defective places upon the grinding surfaces, and also at some part of the surfaces in contact with the contiguous temporary teeth. The exceptions are very rare. From the time, therefore, that these teeth make their appearance they should receive careful attention from a dentist.

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* FIG. 13.—Temporary teeth and first permanent molars, *a*, *a*, of the upper jaw.

Decay sometimes occurs at the defective places of the grinding surfaces as soon as the teeth pass through the gum, but, unless they are extremely frail, it does not usually make any serious progress until the crowns of these teeth have reached their full growth. As soon, however, as decay is discovered at the defective places referred to, it should be cut out, and the cavities filled with gold. This, indeed, should always be done as soon as it is found that the defects in the enamel—no matter how small they may be—extend through to the dentine. Attention to these teeth is required at such an early age that it is sometimes difficult to fill them well, even if the necessary operations should not be painful, as the fatigue and discomfort attending them are more than most children will bear patiently. It may not unfrequently, therefore, be found that fillings at these defective places will require renewal, sometimes more than once, even after the best that can be has been done. All that can be accomplished, in some cases, is to retard the progress of decay until the child becomes old enough to bear the performance of more perfect operations. Sometimes, for this reason, it may be advisable to resort to other materials than gold for the purpose, even if the fillings should be merely temporary. Most children, however, bear such operations sufficiently well, especially—as should always be done—if the decay is attended to at an early period, and before the dentine becomes sensitive.

As has been said, the treatment of decay, occurring at the places referred to, is generally a very simple matter. But the surfaces in contact with the adjacent temporary teeth are very liable to decay, as has also been stated. So much so, indeed, that a very small proportion of these teeth will escape an attack at the places indicated. In Mr. Tomes's tables it is shown that out of 819 first molar teeth extracted, decay had commenced on the surfaces referred to in 263, and in but 401 at the defective places of the grinding surfaces. When it is considered that the temporary molars are frequently lost before those of the permanent set make their appearance, thus leaving these surfaces isolated, this number represents a very large proportion. The remaining 155 teeth were extracted in consequence of decay on the distal surfaces. In many cases decay, occurring at the points referred to, will go on before its existence is suspected until the nerve is reached, and then the loss of the teeth affected is inevitable. This results from the fact that the fangs of the teeth remain incomplete some time after the crowns appear to be perfectly formed; any attempts to destroy the nerves before the roots are completed will fail.

But even if the nerve does not become exposed, the extreme sensibility of the dentine, resulting from decay, renders it very difficult to fill successfully, for a child, such cavities as form on these surfaces.

The principal object of this treatise is to show that decay of the teeth, as common and destructive and difficult to arrest as it is, after it has occurred and been allowed to progress to any considerable extent, can generally be *prevented* from attacking the teeth. In the case now under consideration decay is, of course, certain to attack these molar teeth at the defective places in the crowns, and it must be arrested in the manner described. There are no means now employed, so far as I know, of preventing decay at these points, except filling up the defective places. But decay occurs so rapidly after these teeth are formed, that cavities exist before an opportunity is afforded of filling up the defective places to prevent the occurrence of decay. In the case of decay of the grinding surfaces of the molar teeth, however, any attempt at prevention is a matter of comparatively little consequence, as these surfaces are always open to inspection, and decay cannot progress without detection so as to produce cavities that would endanger the preservation of the affected teeth, or render difficult operations necessary.

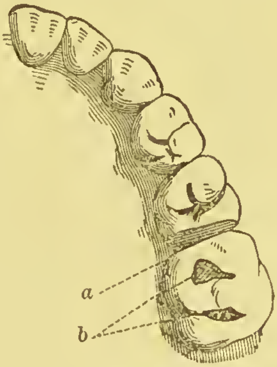
But decay is quite sure to attack the surfaces of these teeth in contact with the temporary molars.

It is very rarely that they escape. It will be observed, however, that no exposed surfaces of these teeth suffer from decay. The surfaces toward the cheek and the tongue remain perfectly sound unless there is some defect in the enamel, or the child is uncommonly negligent. Now, if the mesial surface were exposed, like those just referred to, there is no more reason why it should suffer from decay than the latter.

If the temporary molar were at once extracted, this surface of the permanent molar, as is quite obvious, would be entirely free from any risk of an attack of decay. But such a course would be inadmissible, as, although it would in time be replaced by its permanent successor, yet there are important reasons why it should be preserved. But there is no necessity for its extraction; the object in view can be accomplished effectually by other and more simple means.

The first step, then, in the management of the teeth, in accordance with the plan I propose, is now to be taken. Its advantages are so obvious, in view of the explanations thus far made, that it

FIG. 14.*



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* FIG. 14.—One half of the upper teeth at seven years of age; *a*, temporary, separated from first permanent molar, as explained; *b*, defective places in enamel filled.

would seem to suggest itself. As soon as the first permanent molars are formed, the temporary molars in contact with them should be cut away, so that the permanent molars may be left isolated, as shown in Fig. 14, *a*.

This course I pursue in the case of every child that comes under my care. By means of this simple operation these vulnerable surfaces are placed in such condition as to be free from any liability to decay. In this manner decay of these surfaces is *prevented*.

Whatever groundless objections (for I have heard of none, and can conceive of none, which have any force) may be urged against the principal features of the system I am advocating, none can be made to this treatment. If decay should never attack the permanent molar teeth at the points referred to, even if the separations were not made, the cutting away of these temporary teeth cannot be, in any way, injurious, as the enamel of the permanent teeth is left intact. If the temporary teeth, so treated, should decay, which is not probable, as a consequence of the operation advised, it is a matter of but little importance, as they must be lost in the course of nature in a few years. But, as almost universally happens, and, as has been shown, the permanent molar teeth do decay, frequently and rapidly, at the points referred to. The service advised must be admitted to be invaluable if they are protected from an attack of decay.

I know of nothing that would be more likely to lead to the adoption, by dentists, of the whole method of treatment I propose to explain than the separation of these teeth as directed. Let any one perform the operation advised, a few times,—no injury can possibly ensue,—and he will be greatly surprised at the result. He will find the first permanent molar teeth decayed so much as to require filling, where they are in contact with those of the temporary set, in the greater number of cases, in less than one year after they are formed. In most of these cases there will be no appearance of decay until the separation is made. If the treatment advised is thoroughly carried out, the first permanent molar teeth may be considered secure from decay for some five years, or if decay should attack the surfaces isolated, as advised, it immediately becomes apparent.

I consider it a matter of importance that every possible effort should be made for the preservation of these teeth, because I consider them of great value (more, unquestionably, in view of their larger size, than any of the other molar teeth); and I am disposed to urge this matter because they are generally either permitted to decay without any attempt being made to preserve them, or are ruthlessly extracted even when perfectly sound.

I am aware that these teeth have always been under the ban of dentists and writers upon dentistry with few exceptions. The works which I read as a student, the instructions I received from preceptors, the opinions of many of those with whom I, at that time, and subsequently, came in contact, were all to the effect that the loss of these teeth is a positive advantage. It always struck me as a strange admission, that if the rest of the teeth could be saved by treatment within the resources of dental surgery, that these most important teeth must necessarily be sacrificed. I never assented to this view when a young man; the lessons of a long experience have satisfied me that the treatment based upon it is fallacious and injurious. I do not admit the conclusion that *all the teeth of all persons*, with very rare exceptions, *cannot be preserved by proper attention.* The extraction of any of the permanent teeth is, in my estimation, a serious evil, and one which should, if possible, be avoided. It is sometimes, indeed, necessary to extract teeth for the correction of irregularities, as will be explained; this should be, with rare exceptions, to which I will refer, if proper and timely attention is given to them, the only cause that will justify their sacrifice.

This is a matter of too much importance in its bearing upon the welfare of the community, so far as it is concerned in the preservation of the teeth, to be passed over lightly. An examination of the principal reasons urged, why it has been, and is, considered best that the valuable teeth now under consideration should be given up to decay, or sacrificed, at a certain period of life, whether they are attacked by decay or not, may well be made in carrying out the design of this treatise.

It is stated, and it is certainly true, that:

1st. These teeth are very liable to decay. More so, apparently, than any of the others. Mr. Tomes, in the tables already referred to, recording the extraction of 3000 teeth of all classes, shows that more than one-third (1124) were first molars. It is usually the case that the mouth, during the time of the process of shedding, is in an unhealthy condition, in consequence of the presence of decaying teeth of the first set, no attempt being usually made to preserve them. Proper attention to cleanliness of the teeth is rarely given, at this time of life, and the secretions of the mouth necessarily become vitiated. All the conditions are unfavorable, and it is a matter of common observation that scarcely a child escapes from early decay of these teeth. It seems, therefore, to have become a settled conclusion among a very large number of dentists that, as the teeth in question are so extremely liable to decay, it is useless to waste any efforts in attempts to save them, as:

2d. There are certain advantages alleged to be derived from their extraction. The remaining teeth, having more room, after their removal, will, it is stated, separate from each other, and, for this reason, be less liable to decay. In cases of irregularity the extraction of these teeth is especially recommended, because they are large, occupy a great deal of space, and will afford relief in a crowded condition of the canine and incisor teeth.

Let us examine these reasons for the sacrifice of the teeth in question.

1st. It is true that these teeth, as has already been accounted for, are very liable to decay, and that a large majority of children lose them; but their loss is generally the result of neglect.* As already stated, most persons suppose that they belong to the first set, and, if lost, will be replaced by others. It is generally considered folly to commence operations upon the teeth at such an early age. Many persons, who are governed by such impressions, merely require to have the matter explained to them to understand it, and to avoid a very injurious error. But, however this may be, a dentist should not base his general practice upon a condition of things resulting, in certain cases, from influences beyond his control. If from neglect or ignorance the great majority of children should suffer injury in this way, it is no reason that those of parents, who are willing and anxious to have done all that is possible for the preservation of the teeth of their own children, should see them suffer in the same way. A dentist is bound, in each particular case, carefully to consider what is the best course to pursue, and to avoid adopting, and invariably allowing himself to be governed by, any general rules which may in individual cases be injurious.

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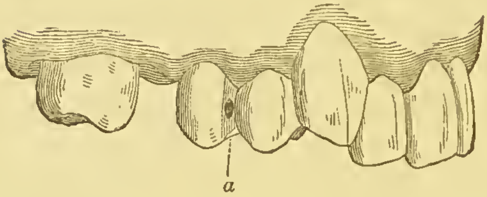
* In Mr. Tomes's recorded cases, his patients were principally poor persons, who never had attention of any kind given to their teeth. They were extracted to afford relief from suffering.

The first reason given for the sacrifice of these teeth has no weight in the case of a child intrusted entirely to the care of a dentist. No matter how liable they may be to decay, they can, with rare exceptions, be preserved as certainly as any of the rest of the teeth, if they receive timely and proper attention. This attention should commence, as already stated, as soon as they make their appearance. I should consider myself chargeable with unpardonable negligence if I failed to accomplish this object in the case of any child intrusted to my care, and sent to me as often as I wished.

2d. It is claimed that by the extraction of these teeth those remaining will be less liable to decay. That the space gained will result in the separation of the bicuspid teeth from each other, and from the canine teeth, by falling slightly back, and that eventually the second molars will come forward so far as very nearly or quite to fill up the spaces occupied by the first molars. If this were to take place uniformly, as sometimes happens, it might be advisable to adopt this plan of treatment. But, unfortunately, this is not the case, and the teeth referred to, in front of the first molars, often remain in close contact, and, in consequence, are attacked by decay, even after the latter are extracted. Where the front teeth are crowded, I have never known them to change their positions as a result of the extraction of the first molars without mechanical assistance. Fig. 15 shows the truth of both these statements, in the case represented at least, and such cases have very frequently come under my observation. It will be seen that even the canine tooth occupies an irregular position, although, at the time the model was made, several years had elapsed after the extraction of the teeth referred to. The second bicuspid, next to the space, had not changed its position, and was decayed at *a*, some two years after the operation, so much that the nerve was nearly exposed at the time it was examined by me. Decay had also attacked the distal surface of the first bicuspid. In this case the teeth extracted were perfectly sound, and it was precisely for the object in the accomplishment of which it completely failed that the four first molars were extracted.

FIG. 15.



Some time before the patient was seen by me the first bicuspid of the opposite side was extracted, in order to correct an irregularity of the canine similar to that shown in Fig. 15. This was not really necessary in this case, as the bicuspid teeth could have been moved back by mechanical appliances after the first molars had been sacrificed. It was done by the operator who extracted the molar teeth. I do not deny that by proper management the irregularity might not have been corrected, but the same object could have been accomplished by the extraction of one of the bicuspid teeth without subsequent attention of any kind, and without the sacrifice of a much more important tooth.

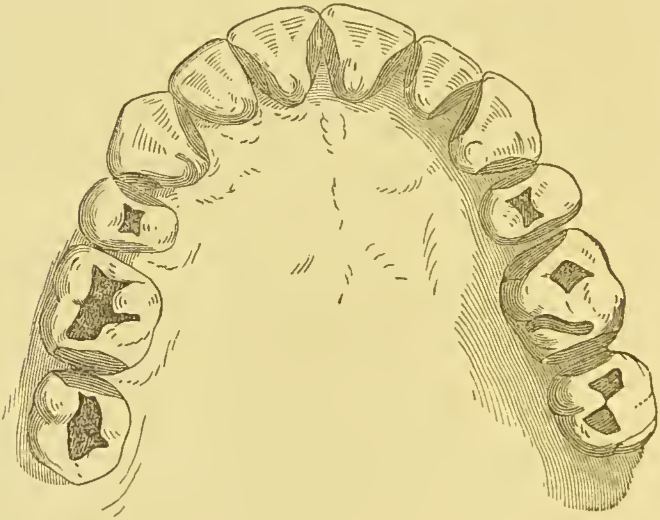
Now, it very commonly happens, even after these teeth are needlessly sacrificed, that all the upper bicuspid teeth are lost by decay. People who will take the trouble to observe the teeth of their adult friends will find that large numbers of them have lost these latter teeth as well as the molars.

About the time of writing the above, I had under my care two members, now adults, of a family of four children who were subjects of the treatment under consideration. At what the dentist, who has great reputation with his patients as an "operator," considered the best time to secure the desired result, the four first permanent molar teeth of each patient were extracted; some were perfectly sound, and others but slightly decayed. There was no deficiency of room in these cases, but all the teeth occupied perfectly regular positions. This case was successful, so far as regards the filling up of the spaces occupied by the extracted teeth. The second molars came forward, in time, until they touched the second bicuspids, both above and below. The absence of the extracted teeth would not have been observed except by a dentist. Yet all these teeth were attacked by decay on the surfaces in contact. In the case of one of the subjects of this, under the circumstances, barbarous treatment, it was with difficulty, after much suffering occasioned by the necessary operations, that the bicuspid teeth could be saved before he became nineteen years of age, as they had been permitted, under the care of the same individual, to decay until the nerves were nearly exposed. In these cases it is seen that these valuable molar teeth were extracted: some of them perfectly sound, and others so nearly so that there would have been no difficulty in preserving them to prevent decay in those which remained. They were sacrificed for an object which was not accomplished. Such cases, so far from being uncommon, are of daily occurrence. It may be mentioned in connection with this case, that the youngest child of the same family was placed under the care of the same dentist, who commenced for her the same treatment. The child was placed under the influence of nitrous oxide gas, and one of the sound lower molars extracted. Fortunately for this child, the difficulty attending the extraction of this tooth was so great that the rest escaped. The remaining molar teeth were not only preserved without filling on the proximate surfaces, but decay has been prevented from attacking the adjoining bicuspids.

The cases cited prove, conclusively, that the sacrifice of the teeth in question fails to accomplish the preservation of the remaining teeth, at least in all cases. That it sometimes aids, materially, in this object no one of experience in the practice of dentistry will undertake to deny. But, so far as the treatment of decay of the teeth is concerned, no competent dentist needs such aids. By means of the course of treatment I am advising, or, indeed, by the thorough and faithful application of the present methods of practice, these, and all the teeth, may be preserved during the usual term of life. The teeth are very rarely so much crowded that all the desired space may not be gained by the extraction of one of the bicuspid teeth, which are far less important than those in question.

The incisor teeth may, indeed, take their proper places; but, in some instances, so completely fill up the arch that the laterals come in contact with the first bicuspids and exclude the canine teeth from it. This is a very common form of irregularity of the teeth, of which Fig. 15 represents but a slight case. It is important, for many reasons, that these canine, or eye teeth, should be preserved. But, in order to obtain room for them in the arch, some other teeth must, in such cases, be sacrificed. It has been shown that the sacrifice of the first permanent molar teeth under consideration does not always at least accomplish this object. It certainly failed in the case cited. In accordance with my observation it rarely does without mechanical assistance being employed to move back the bicuspid teeth. The irregularity referred to will, in most cases, correct itself if one of the bicuspid teeth, generally the first, is extracted, and will afford all the space necessary. Fig. 16 is drawn from the model of a case of this character. It will be seen that the spaces are completely filled up, and the perfect symmetry of the arch preserved.

FIG. 16.*



As both the canine teeth were standing out of the arch, it became necessary to extract a bicuspid on each side. Notwithstanding the great importance of the canine teeth, they are sometimes extracted in such a case of irregularity as I am noticing. This should never be permitted, and no one, I am sure, would be guilty of such a piece of malpractice unless he were grossly ignorant of his profession. Sometimes the lateral incisors are extracted, when the teeth are crowded in the manner described. I have seen some shocking cases of mutilation attributable to this cause. Such treatment always produces serious disfiguration, and is entirely inadmissible except in very rare instances.

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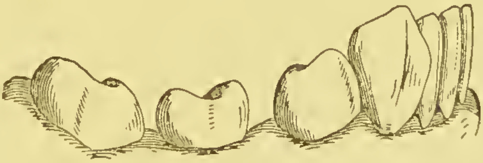
* FIG. 16.—Showing result of extraction of the first bicuspid teeth in a case similar to Fig. 15. The eye teeth in this case took their proper places without mechanical assistance. This figure is intended to illustrate other points of treatment also, and will again be referred to.

The same treatment is resorted to in order to relieve a crowded condition of the lower front teeth. I have never known it to succeed in a single instance, although an irregularity of this kind is very easily corrected by the extraction of a comparatively unimportant tooth. Fig. 17 represents the teeth of a girl for whom, as in the case, Fig. 15, the four molar teeth had been extracted for the purpose indicated. It is at once seen how futile it was for the object in view in her case, and how injurious in result. It is seen that the irregular

FIG. 17.



canine still retains its position, although so near the space made by the falling back of the second bicuspid. It must be apparent that no relief for a crowded and irregular condition of the incisor teeth can be expected from such treatment. I shall presently refer again to this case as an illustration of an important point in this connection. The lower incisor teeth are very frequently irregular and crowded together. The extraction of one of these teeth is the simplest remedy for the correction of such an irregularity. It is perfectly effectual. As the four lower incisor teeth are of very nearly uniform size, and are little seen, comparatively, in ordinary conversation, the loss of one of them is rarely observed. This is not the case with the upper teeth of the same class; the loss of one of the upper incisors or canine teeth produces a deformity always to be deplored.

With regard to this general sacrifice of the first permanent molar teeth, it is generally agreed (I cannot refer to authorities in a treatise of this nature) that, to reap the full advantages of the practice, all four must be taken out. If any are allowed to remain, they prevent, in most cases at least, the teeth of the opposite jaw from moving toward the spaces made. I have known all four of these teeth in a perfectly sound condition, with no marked indications of a tendency to decay in any of the rest of the teeth, torn out of the mouth of a child to *prevent decay which might never have taken place.*

I have known this to be done, too, by persons who profess to be shocked at the idea of making slight separations of teeth which exhibit every indication of an attack of decay. The idea of separating "sound teeth" is insufferable to men who make an invariable practice of dragging out of mouths of every child in their power four of the largest and most important teeth, although they may be entirely free from decay. While I am ready to admit that there are cases in which the extraction of these teeth would prove a positive advantage, and do not undertake to judge of the practice in this respect of competent men, yet I have no hesitation in denouncing the indiscriminate extraction of these teeth as barbarous in the extreme, and I cannot refrain from asserting strongly my decided disapprobation of any course of treatment that will permit these teeth to be destroyed, even when attacked by decay at an early age, if there is a reasonable hope of preserving them by operations which every one worthy of a place in the dental profession is perfectly capable of performing.

But even if it be admitted that the sacrifice of these teeth is advisable, there are certain important considerations with regard to the matter that must not be overlooked. If these teeth are taken out too soon it is seriously injurious. Those who have given most attention to this matter say that they should be preserved until about the eleventh year, even if it is intended to sacrifice them. Now, in most cases these teeth, if they receive no attention, will be destroyed by decay before the eighth year. They must, therefore, be protected from decay or extracted long before the time for securing the best results. It is obvious, then, that in any case, whether their final extraction is considered an advantage or not, in order to derive the fullest benefit from this plan, it is important that every effort should be made to preserve them for several years after they come.

It is easily understood that parents cannot hesitate to permit these teeth to be extracted for their children when badly decayed, but when it has been shown by the result that the decay has been arrested for several years by the proper attention, it is difficult to comprehend how any person of sound mind can permit such a serious injury to be inflicted as the extraction of such teeth or of perfectly sound teeth. Yet, strange as this seems, it is done every day. It is to be regretted that the parents themselves were not to be subjects of the injury they allow to be inflicted upon their children, simply because they will not give a little thoughtful attention to a matter of so much importance, and one so easily understood.

But the loss of the teeth in question, except in rare instances, is injurious in a way that few people suspect, until the disaster, as life advances, is forced upon their attention.

When the teeth are fully developed, and fill up the places on the margins of the jaws, they afford each other mutual support. The teeth of the two jaws are so arranged that the elevations and depressions upon their surfaces come together in such a manner as best fits them for their intended purposes. If, from any cause, they are thrown out of their positions, this perfect adaptation is broken up and their usefulness so far impaired. If a single tooth is extracted, and those adjacent move into its place, the proper antagonism of these teeth with those of the opposite jaw is destroyed, and their efficiency for the important act of mastication so far impaired.

But the injury is not confined merely to this result. When one of the teeth is removed, the corresponding one of the opposite jaw loses its support, and if the teeth next to the extracted tooth do not change their positions, it gradually becomes elongated, more or less irritation of the membrane of the roots result, absorption of the sockets follows, and the tooth is eventually lost from this cause. This is one of the reasons urged, indeed, for the extraction of all four of the teeth in question if one is extracted.

But a similar injury occurs in another way. If they should be extracted, the result in early life, if the spaces left by their extraction are not perfectly closed up, may be merely some inconvenience and annoyance. But, as life advances, the teeth next to the spaces suffer from want of the support of the extracted teeth. The tendency is to fall toward these spaces, although they may be kept in place by the teeth of the opposite jaw. In such cases the result of the pressure upon the sides of the sockets, toward which the teeth tend, is their destruction by absorption. Even in cases where they are kept perfectly in position by the opposing teeth, the gums recede on the sides toward the spaces, and the gradual absorption of the sockets follows. Sooner or later the sockets of these teeth are all absorbed, irritation and chronic inflammation of the surrounding membranes of the fangs occur, the teeth referred to become, from time to time, so tender to pressure that the side of the mouth on which they are situated is useless for the purpose of mastication. When, as is not unfrequently the case, the teeth on both sides of the mouth are in this condition, it is almost impossible to masticate the food with any comfort. Finally, the teeth in question become so painful and loose that their extraction is rendered necessary. When they are removed, the adjoining teeth, although perfectly sound, are affected in the same way, and, probably, at the age of fifty the sufferer, at a time of life when the natural vigor of the stomach may be more or less impaired, finds himself without molar teeth for their necessary uses. What he eats is imperfectly prepared for its reception in the stomach. He does not enjoy his food, impaired health often results, and it is no stretch of imagination to suppose that life is materially shortened, in many instances, by this condition of the teeth. I have no question that many of my readers who have passed the prime of life will find this a description of their own cases.

The deliberate determination on the part of a dentist to allow these important teeth to be destroyed by decay, unless the jaws are overcrowded, is to me one of the strangest anomalies in connection with the practice of dentistry. The extraction of these teeth, however early in life, is always risking such a result as I have described.

I will state a case with which I have been familiar for many years. The patient, now fifty years of age, had no opportunity, when a boy, of obtaining proper attention to his teeth. Although they were not nearly so liable to decay as those of the great majority of children at the present day, the nerves of the two first lower molar teeth became exposed, and they were extracted to afford relief from the toothache that resulted. For many years their loss was not very seriously felt, although certain kinds of food could not be eaten without discomfort. At about forty years of age the bicuspids and second molar teeth, next to the vacant places, became tender, and the sockets were gradually destroyed, until it became necessary to have the teeth in question extracted. On one occasion, the continued suffering caused by one of the teeth, when the individual referred to was in a depressed state of health, led to a very serious attack of illness. On the left side but one molar remains, and it is almost useless (although not decayed), as the parts about it are in a state of constant, though slight, inflammation. In a short time it will be lost.* On the other side, very nearly the same condition of things exists, and in the course of one or two years there will be no teeth left in the lower jaw except the incisor and canine teeth. None of the teeth of the upper jaw have been lost, but are likely to be retained during the balance of the lifetime of the individual referred to, and would be most serviceable if there were any opposing teeth. The jaws in this case were large, and afforded ample room for all the teeth. In a case of this kind it becomes very difficult to supply the vacant places with serviceable artificial teeth unless all the lower teeth are extracted, and few persons are willing to permit the extraction of six firm, sound, and healthy teeth for what, to them, may appear a doubtful result. So they go on, enduring more or less daily suffering, until the remaining teeth are lost, one after another, by the process just explained, and this may not take place until the necessity for teeth in their individual cases no longer exists.

To persons who have passed through life without any trouble of this kind, it may seem that I am making out of the loss of a few teeth a very important matter. But an injury which causes daily discomfort, occasional severe suffering, as life advances, damage to health and consequent shortening of life, is certainly not a trifling matter. I am sure that no one who has suffered in the way that hundreds, who come to the notice of every dentist, have suffered, and continue to suffer, will consider it so. But the mass of such people look upon this as an unavoidable result. They suppose that the teeth will decay and be lost in spite of any service dentists are capable of rendering. This is not the case, however; all the suffering described is unnecessary, and parents should remember that a mistaken operation, such as I have pointed out, if performed for their children, may inflict an injury, from the consequences of which there is no escape during life.

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* Since the above was written, the tooth in question became so tender and painful, although but very slightly decayed, that its extraction was necessary.

I would urge my fellow-practitioners of dentistry, who have been pursuing the system referred to, carefully to review the matter. I do not question the fact that the extraction of the first permanent molar teeth will prevent the occurrence of decay on the surfaces of the teeth contiguous to them for the time they remain separated from each other. But if I can make it clear that the same object can be accomplished by the artificial separation of the bicuspid and molar teeth, no one will contend that the sacrifice of these teeth, with all its occasionally, if not frequently, serious consequences, should not be avoided. If it is possible to save these teeth by simple and very feasible operations, it is difficult to understand why they should be sacrificed, as is now so often indiscriminately done. If it is sometimes important to resort to this practice, let the cases in which it is of positive advantage be carefully discriminated.

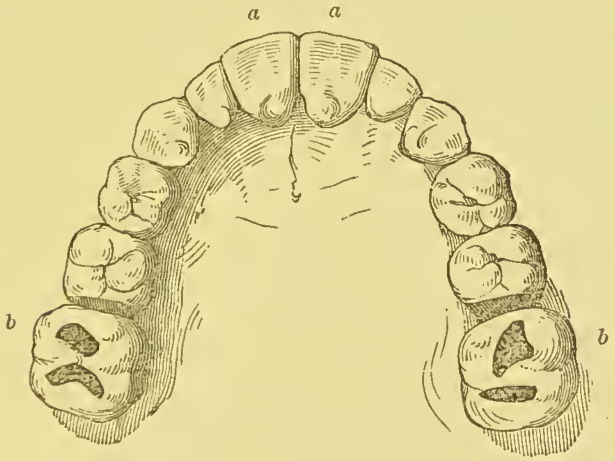
I am compelled to say, on careful reflection, that sometimes these teeth are so frail in structure, and so extremely liable to decay, that, as I have already intimated, repeated operations are sometimes necessary to preserve them. In some rare cases it must be admitted that their preservation is nearly impossible. The operations required become, even if successful, expensive, and when the cost is a matter of importance, it may be better to sacrifice these teeth in order to lessen the expense and the difficulty of preserving them and those which remain. It is simply, however, in most cases, the sacrificing of valuable teeth, with certainty of results more or less injurious, to which I have called attention, to save a comparatively trifling expense. But in cases where the expense cannot be met, there is no alternative.

V.

THE INCISOR TEETH.

AT about the time when the first permanent molar teeth, which formed the subject of the last section, make their appearance, the four temporary central incisors, two upper and two lower, gradually become loosened, in consequence of the absorption of their roots, and drop out. They are succeeded by the permanent teeth of the same

FIG. 18.*



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* FIG. 18.—Upper teeth at about the eighth year. *a*, *a*, permanent central incisors; *b*, *b*, first permanent molars, isolated, and filled as described in previous section. Intermediate to these are the remaining temporary teeth.

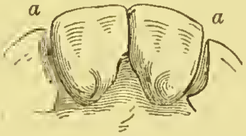
class, Fig. 18, *a*, *a*. At the stage of development of the upper teeth, now reached, they present the appearance shown, provided, of course, that the temporary teeth have not, as is frequently the case, been destroyed by decay.

By following out the plan of treatment advised, the first permanent molar teeth have been rendered, for the present, secure from decay: the defective places in the enamel of the grinding surfaces have been filled and the contiguous temporary teeth cut away from contact with them, Fig. 18, *b*, *b*.

The incisors differ from the teeth referred to, in the respect that the enamel with which the crowns are covered is, generally, free from defective places, so common to the grinding surfaces of the molars. But, as has already been explained, decay occurs not only at defective places in the enamel, but also upon surfaces where it may be perfectly formed. It is probable that the incisor teeth of more than nine-tenths of the children of the better classes of people in this country are attacked by decay on some parts of the surfaces in contact, unless special care is taken with them, before they have been formed a single year. It progresses with varying degrees of rapidity, depending upon causes already indicated. But whether its progress be slow or rapid, it is important that, when it does attack the teeth, its presence should be detected at the very earliest moment.

As these teeth are liable to decay, not only where they touch each other, but where they are in contact with the temporary teeth, the first step to be taken, in carrying out the treatment now proposed, is to cut away the mesial surfaces of the temporary lateral incisors, as shown in Fig. 19, *a*, *a*.

FIG. 19.*



By means of this simple operation, the distal surfaces of the permanent central incisors are rendered free, for the time, from any liability to decay. It is obvious that this treatment can do no possible harm, even if the teeth in question should never without this precaution be attacked by decay. The temporary teeth referred to, however, are frequently lost before this time of life, or become separated from the central incisors, as a result of the natural growth of the jaws. It is a preventive measure of the same character as that adopted in reference to the mesial surface of the first permanent molar, and which will have proved itself effective for the object in view.

Attention is now to be directed to the surfaces in contact of the central incisors. It has been explained that decay attacks these surfaces only as a result of the lodgment of particles of food, etc. upon them, although the enamel be entirely free from defect. It is obvious, therefore, that if it were possible to keep the sides in contact as well cleansed as the surfaces toward the lips and tongue, they would remain equally free from decay. Very careful attention to cleanliness of the teeth, on the part of children, is essential to their preservation. They should be brushed several times during the day, certainly after every regular meal, on retiring at night, and in the morning before breakfast. Some suitable tooth-powder should be used, sufficiently often to prevent them from becoming stained. But it is still more important that some substance, such as floss-silk or thread, should be frequently passed between the teeth, in order to remove particles of food, the mucous secretion, or deposits of any kind from these places. If this were regularly and carefully done, it would contribute greatly toward the prevention of decay at the places referred to. But, notwithstanding the importance of the object to be effected, directions of this kind will, so far as my observation goes, rarely lead to the requisite attention.

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* FIG. 19.—Mesial surfaces of temporary laterals cut away from contact with central incisors.

In the great majority of cases, then, these teeth will decay at some points upon the proximate surfaces, and their preservation will depend upon the knowledge, skill, and care of the dentist to whom the child is intrusted. Decay will generally occur at the places referred to, as has already been stated, before these teeth have been formed a single year. It generally commences as soon as they reach their full growth. But in the proper management of the teeth, its very first approaches should be detected. The time, I trust, will come when every dentist, who has undertaken the professional care of a family of children, will be held chargeable with malpractice if he should permit any of their incisor teeth, except in very rare cases, to decay so far as to require filling, provided always that his directions are strictly complied with.

There are some children, but such instances are very uncommon, who have teeth so well formed that they are not liable to an attack of decay. The characteristics of such teeth are strongly marked, and readily recognized by any competent dentist. But however perfect in structure they may appear to be, the condition of the central incisors should be frequently and carefully scrutinized during the first year after they take their places at the points where decay is likely to occur.

The surfaces in contact of these teeth should be carefully examined once a month at least, if they present the usual appearances of a tendency to decay. For this purpose they should be pressed apart, as can easily be done by the employment of thin pieces of ordinary tape.* A single piece is first introduced; after it has remained several hours, it is removed, and a piece double the thickness inserted. By gradually increasing the thickness of the tape employed, as wide a separation as may be desired can be made in the course of twenty-four hours, without producing any considerable irritation of the surrounding tissues. The teeth are pressed apart, in the manner indicated, so that the proximate surfaces can be thoroughly inspected. But after this separation is made, a hasty examination with a mouth-mirror is not sufficient to determine their condition. Decay at its inception is very different, in appearance, from what it becomes after it has made some progress.

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* Strips of india-rubber are sometimes employed for this purpose, but they are objectionable, unless used with much caution, for the reason that they produce considerable inflammation of the surrounding parts, attended with great soreness or tenderness to the least pressure made upon the separated teeth. I have known the

Sometimes the affected point becomes slightly discolored as soon as decomposition commences. When the teeth are in close contact, however, they may become stained by a desposit upon them of some coloring matter, contained in the fluids of the mouth or mingled with them, without any decomposition of the surface whatever. Whenever a greenish and tenacious deposit is present on the outer surfaces of the teeth, along the margin of the gum, some decomposition may be looked for, but a blackish stain may occur on surfaces not accessible to the brush, and yet they may be sound. The mere discoloration of a surface is, therefore, not

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vitality of the teeth destroyed by separating them incautiously in this way.

decisive as regards the existence of decay, and other evidences must be sought for.

Sometimes the affected surface, although the decomposition may have progressed for some time, is not stained. It becomes, indeed, whiter than the normal enamel, but the whiteness is opaque, and can at once be recognized, on simple inspection, as differing from the peculiar, semi-translucent hue of the surrounding intact enamel.

But the most reliable test of the condition of the part under examination is its character as regards consistency, and this can best be ascertained by the use of a fine, sharp, cutting instrument. By this means the very first approaches of decay can be detected, in consequence of the softening of the affected places, resulting from their decomposition. Even in the very earliest stages of decay, if a comparison is made (by using such an instrument as I have described) between the sound enamel of the naturally exposed surfaces of the teeth and that portion under examination, it will be found that the latter has lost the hard, flint-like character possessed by the former, and may be cut or scraped away, although no visible change may have taken place. From these small spots of slightly decomposed enamel the process of destruction will go on, unless some means are employed to arrest it, until the affected teeth are entirely destroyed.

It has been generally admitted by writers upon dentistry, and dentists of all grades, that decay of the proximate surfaces of the incisor teeth of most individuals might be prevented if they were kept thoroughly cleansed in the manner already stated. This has been a favorite subject upon which a great deal of advice has been given. But the advice has, to a great extent, been wasted. It is true that if young people could be induced to consider their teeth of as much importance to them as they really are, and would give such careful attention to their cleanliness as any competent dentist would advise, a great deal might be done to prevent decay without the necessity for operations of any kind. But notwithstanding all the urgings of some of the best men in the dental profession, their advice is not followed, except to a very limited extent. The requisite attention is not given. The incisor teeth at the points of contact do decay, even among the best classes of people, and will continue to decay. The ravages of this disorder will be stayed just in proportion to the means employed to lessen the amount of personal attention required, or to its reduction, to that degree which people of any pretensions to refinement will always consider necessary to fit them for intimate social intercourse.

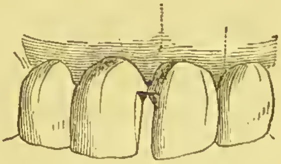
But the most careful and prompt attention is to be given to the treatment of decay of the teeth in question after it has actually commenced on the surfaces in contact. Decay may be detected, as already stated, when it is confined to the very surface of the enamel. The decomposed portion of the affected surface may at first be removed by simple friction. A little powdered pumice-stone taken upon a piece of tape moistened with water and drawn rapidly to and fro for a sufficient time over the affected surfaces will answer; by this means all the softened portions may be removed. These surfaces may be polished so as to resemble the intact enamel. This is a plan of treatment which has been advised in order to avoid the necessity of making a permanent separation, or of entirely removing the enamel from the affected places. After this is done, the teeth are allowed to resume their former positions and to come again into close contact. Directions are given to observe great care to keep these surfaces perfectly cleansed; but if decay of the sound enamel has resulted from negligence, how can it reasonably be expected that the greater care now required will be taken after the surface of the enamel has been decomposed? It is true that after atttention has once been aroused to the injurious results of negligence, the individual interested may take greater care than before, but this, I fear, will not be the general rule. I certainly have not found it to be so. It may be considered advisable, in cases where the child under treatment is likely to receive the necessary attention, to endeavor to arrest the decay by the means proposed, watching the teeth with great care. I have great confidence in the statements of one of my contemporaries, who assures me that he has for many years relied upon this means of arresting decay with success; but I am compelled to say that in my own practice I have never succeeded in inducing children, or their parents for them, to take sufficient care to be enabled to rely upon this means of arresting decay.

It has been explained that a permanent artificial separation of these teeth will so lessen their tendency to decay that it is not liable to occur. This was shown in the case illustrated by Fig. 10. The separation in this case was made with the file.

A strong and very natural prejudice exists against the employment of this instrument for dental operations. The prevalence of such a feeling is easily accounted for. The general impression, as I have shown and have explained to be a mistake, is that the use of the enamel is to protect the teeth from decay, and that its removal by filing, or by any other means, exposes them to certain destruction. In former years, when the file was in general use for this purpose among dentists, a very small number knew anything about the business they had undertaken. There were no means of instruction generally attainable. Men became dentists at will, and without any professional education whatever. The file was used by most of them without any proper knowledge of what it was intended to accomplish, and in the most bungling manner. The front teeth were filed, as a common practice, whether decayed or not. If decay were present, no effort was made to effect its entire removal, and it was not even stayed in its progress. Or if the decayed portions were filed entirely out, the filed surfaces were allowed to come again in contact, and in such case the dentine was really as liable to decay as before the operations were performed. The unfortunate subjects of such operations relied upon them to preserve their teeth, and supposing the teeth to be sound, or only slightly decayed, at the time they were filed, naturally attributed their loss, by a renewed attack of decay, which was a mere matter of time, to the operation of filing. The operation, too, is of such a disagreeable character that it is very naturally shrunk from. It is not only disagreeable, but, after decay has made considerable progress, extremely painful.

But another and very just objection was the disfiguration of the front teeth occasioned by its improper use. Decay of the central incisors, even after it has made considerable progress, may be effectually stopped by filing them in the manner shown in Fig. 20. But very decided and very reasonable objection would be made to any plan of treatment which would lead to such disfiguration. This manner of filing the teeth was not unfrequently practiced in former years, and to this fact is to be attributed, in a great

FIG. 20.



measure, the strong prejudice which now prevails against any use whatever of the file in dental operations. "Filing the teeth" was and is considered equivalent to disfiguring them. The idea still prevails very extensively that filing the front teeth is equivalent to cutting them apart in some such objectionable manner as is shown in Fig. 20. Dentists were, and are at the present time, on undertaking any new case, met with the preliminary condition that the teeth are not to be "filed;" and yielding to this prejudice on the part of the public, it was proposed to avoid the practice by resorting to other means of obtaining the necessary space for "filling" them, until this operation has come to be generally considered the only one to be relied upon for preserving these teeth. To an almost universal extent all efforts to preserve the incisor teeth by the removal of superficial decay, proved in so many instances, by Dr. Hayden and others, to be perfectly effective, were abandoned. Even at the present day, although no one can deny that it is most effectual for the purpose, it is avoided, except in rare cases, and the operation of filling entirely relied upon for this purpose. I have knowledge of but a very small number of dentists who do not rely entirely upon this means of preserving the incisor teeth after they have been attacked by decay.

It has been found, as already shown, that no matter how closely in contact the incisor teeth may stand, they can be pressed apart so far that easy access can be had to their contiguous surfaces. As a substitute for filing, or the removal of superficial decay by any means, it is considered best by many operators to press them apart and cut out cavities in teeth almost perfectly sound, fill them with gold, and, without altering the forms of such teeth, allow them to fall back into their original positions. Or, what is very common practice, a patient is dismissed when the teeth are found to be slightly decayed, with the statement that the cavities are not large enough to be filled, and with directions to return for the purpose after the lapse of some months. I have, indeed, discussed this matter with good operators, who, while admitting the entire efficiency of the method of arresting slight decay by its removal, and without any objection to offer, declared their preference for filling such teeth, even if necessary to form the cavities entirely with cutting instruments.

There is one very serious objection to this method of filling the incisor teeth, and that is that it does not always effect the intended purpose. So far as my own experience and observation go, I found it to fail so frequently that I very soon abandoned the practice after having tested it thoroughly. When the teeth are filled in this way, and allowed to come again into close contact, the secretions of the mouth and particles of food are still retained, and decay is quite as liable (it is difficult to see why it should not be more so) to occur at the junction of the gold filling with the orifice of the cavity as it was to attack the smooth surface of the sound enamel. I have the record of a case, in which a lateral incisor was filled (I have reason to suppose well filled) in this way three times, and decay each time recurred, but which was effectually arrested by filling after the tooth was permanently separated from the central incisor. I have repeatedly met with cases in which the bicuspid teeth had been filled in this manner very beautifully, so far as the management of the gold was concerned, and yet the operations were useless, from the cause stated, or only of temporary advantage. Whatever differences of opinion there may be as to the relative advantages of pressing the teeth apart and permanently separating them by filing, or in any other manner, when they actually require filling, I think there can be none, among those who have most carefully examined the subject, in regard to the impropriety of forming cavities in teeth so slightly decayed that the decay can easily be removed, when it has been demonstrated that they may be preserved by means of such treatment. But, as I have stated, it is claimed that this is done to escape the necessity of making unsightly separations of the front teeth. No such necessity exists. This is an error with regard to the matter that I wish to make plain.

It may be stated here that the *file need never be employed for the treatment of superficial decay of the* *incisor teeth.* The object can always be accomplished by other means.

Even when decay of the incisors has been allowed to progress so far as to render filling necessary, a much more reliable plan of treatment than that described is to cut them away, as shown in Fig. 21, so that the decayed surfaces are rendered easily accessible. After this is done, the contact is effectually broken up, slight shoulders may be left near the gum, or the surfaces treated are so beveled that they do not touch except at the extreme outer edges of the enamel. These surfaces, as will be seen, can be readily cleansed by means of the tooth-brush. This method of filling these teeth, unless there is considerable decay, does not render necessary any change of form, visible on ordinary inspection. The permanent separation is made with properly-shaped cutting instruments. A front view of the teeth separated in this manner is shown in Fig. 22. It will at once be seen that the teeth treated are not at all disfigured by the operation. The permanent space need not be greater than the thickness of ordinary writing-paper, and yet will readily

FIG. 21.*

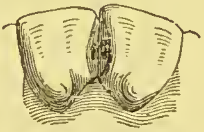
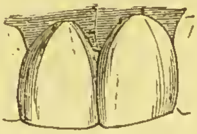


FIG. 22.†



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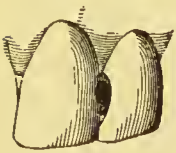
[*] FIG. 21.—Inner surface of central incisors cut away and filled.

[†] FIG. 22.—Anterior surface of teeth treated as described.

admit the passage of the piece of thread or silk used to cleanse them. Or if they are cut at such a bevel that a portion, or even the whole, of the outer edges of the enamel remain in contact, these surfaces are so slight that decay is not liable to occur, and the brush will keep the whole of the separated surfaces cleansed.

This method of preparing the incisor teeth for filling has been practiced successfully for many years by some of the best operators ever known to the dental profession. The method of separating the teeth described, is far preferable to the one frequently resorted to of attempting to avoid cutting them away when they require filling. This is very generally done by pressing them apart, as already explained, and filling them from the front. The result is not unfrequently that the fillings are visible from the front, causing considerable disfiguration, even when the cavities are quite small. This is rarely necessary, and I have no hesitation in saying that, as a general rule, cavities occurring on the proximate surfaces of the central incisors should never be filled fróm the front, unless the decay has commenced so far toward this part that it cannot be avoided. Fig. 23 represents a case of this kind. The drawing was made from a case which recently came to my notice. In this case there would have been no difficulty whatever in so forming the cavi-

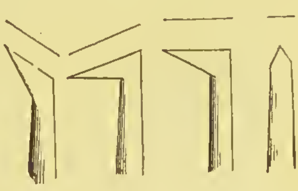
FIG. 23.



ties that the fillings would not have been visible from the front.

The important feature of the treatment proposed is, that decay occurring on the proximate surfaces of any of the incisor teeth *can always be arrested before it becomes necessary to resort to filling for the purpose, and always without the slightest disfiguration.* The same kind of separation as that shown in Fig. 21, if resorted to for the purpose of removing decay before it has progressed so far as to produce a cavity, will be as effectual in arresting it as if separations were made as wide as those shown in Fig. 20. Indeed, as already explained, in many of these cases the fillings occupy only a small part of the exposed dentine. If the part not protected by the gold should be exempt from subsequent decay, why should the whole surface, if it can be cut away before a cavity is formed at all, be subject to decay?

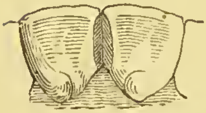
FIG. 24.



I have stated that the file need never be employed for the permanent separation of the incisor teeth. I have of late abandoned its use almost entirely. The object is accomplished by the employment of properly-shaped chisels. Besides such as are in common use, I have found those shown in Fig. 24 remarkably effective. The cutting or abrading edges of these instruments are the right angles formed by their sides and faces. They are made nearly as thin as the steel will admit, in order to facilitate the process of sharpening. The steel is left as hard as it can be made, or the temper but very slightly drawn. They are necessarily delicate and must be used with care, as they are easily broken. It will be found that these instruments remove the portions required with great rapidity. Every part of the heads of the instruments may be employed. The above forms I have found useful, but they can easily be varied so as to be adapted to special cases. They are so readily made that any dentist can construct such a one as he may need for any particular case in a few moments.

In the performance of this operation, the teeth are first pressed apart, as already explained. If both surfaces (we have now the central incisors under consideration) are already decayed so far that the decay has passed through, or nearly through, the enamel, they should be cut away with the chisels above described, so as to make the affected surfaces look toward the mouth, Fig. 25. After this is done, these surfaces should be polished very carefully. A very excellent agent for this purpose is an oxide of tin, or what is known to workers in marble as

FIG. 25.*



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* FIG. 25.—Showing method of removing superficial decay from proximate surfaces of upper central incisors.

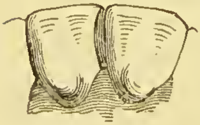
"polishing putty." By means of this material an exposed surface of the dentine may be polished so perfectly as to resemble the enamel itself.

After this is done, those who have charge of the child should be directed, if the tendency to decay is very great, to cleanse the surfaces of the teeth so treated with floss-silk, or, if the spaces will admit of it, a piece of tape wet with alcohol or water and charged with some of the same material, or with prepared chalk. The tape, or silk, when used, should be drawn rapidly to and fro for a short time through the spaces between the teeth and over the separated surfaces. When it is discovered that the teeth are more than usually frail, the dentist who has the case in charge should himself examine and repolish these surfaces once a month, or week, as he may consider advisable, during the first year after he has commenced treating them, or until he is satisfied that the exposed dentine has undergone the change described in Section II. Even after he is satisfied that the change referred to has taken place, he should examine them at such times as he may consider advisable. If the slightest softening of the surfaces treated, as described, occur, they should be cut away again until the sound dentine is reached, most carefully watched, and the surfaces polished at short intervals by the dentist himself. This recurrence of decay may take place even when the separations remain permanent, either from great liability of the teeth to decay, or as a consequence of the careless habits of patients. For failure of operations of any kind from this latter cause no dentist can hold himself accountable.

It will be found that teeth separated in this manner not unfrequently change their positions (especially when they are crowded together), and the surfaces treated come again into contact. This must be looked for, and as soon as it is discovered to have occurred, so much more of the same teeth must be cut away as to make the separations complete and permanent. It must always be borne in mind that if the enamel is filed or cut away from the surfaces of any of the teeth and they fall into contact again, decay is very sure to occur. The enamel, as has been explained, does not prevent an attack of decay when surfaces of teeth are in close contact; yet the dentine, being less compact, is more liable to decay under the same circumstances.

If it is discovered on examination in the manner directed, that the surfaces merely of the enamel of the two teeth in contact are touched with decay, it will be sufficient to cut away one and polish the surface of the other, being sure to remove all the decomposed portions from both. A separation quite sufficient for the object in view can be made, as shown in Fig. 26. It will be found that this method of treating the teeth, so as to leave many of them perfectly intact, is applicable to a greater extent than is supposed.

FIG. 26.



I have called careful attention to the central incisors, because they commonly decay at a very early period after they are formed. The same may be said of the lateral incisors, which are the next of the permanent teeth that make their appearance.

These teeth require special attention, and should never be permitted to decay so far as to require filling, or be subjected to any considerable loss of substance. They are one-third smaller, at least, than the central incisors. The "nerves" of these teeth are comparatively near the surface. If permitted to decay until they require filling, risk is incurred, unless the cavities are very small, of injuring the "nerve."

It should be borne in mind that the "nerve," as it is called, is only the central source or reservoir of vitality of the crown of a tooth. It occupies, as is generally understood, the cavity of the crown and canal of the root, but throws out its myriads of branches to all parts of the dentine up to its junction with the enamel and cementum. It is not necessary, as is generally supposed, that the central cavity should be penetrated to touch the "nerve." As soon as the surface of the dentine is reached, where it is in contact with the enamel, the "nerve" of the tooth is in a certain sense exposed. At any point of the dentine, where a painful sensation is produced by the contact of any extraneous substance whatever, it is only through the agency of the "nerve" of the tooth that the individual becomes conscious of this sensation. Changes in the natural structure of the dentine always follow its exposure. Toward the enamel surface, as already explained, this change is conservative. Up to a certain degree irritation in a vital part leads to increased nutrition,—*i.e.* the natural function of the part is stimulated to increased activity. But there is another recognized principle in disease: that is, when the irritation exceeds a certain degree, the effect is destructive. At the enamel surface of the dentine the vitality is low, and the effect of the action of the agents which produce decay is merely to stimulate the secretion, or formation of lime in the fibrillæ, until they become changed into a hard tissue resembling the intertubular substance. The action is conservative, as already explained. But as the "nerve" proper, or that part of a tooth popularly so called, is approached, the dentine becomes more susceptible to the irritating action of the corrosive agents to which it is exposed. The effect now produced by them differs widely from what occurs when decay first reaches the enamel surface of the dentine. Then, as has been explained, the fibrillæ become consolidated by a deposit of lime. But now, instead of this addition to the part, absorption of the layer of dentine next to the "nerve" takes place, and the "nerve" itself becomes exposed by the deprivation, in this way, of its natural covering.

But even when this result does not occur, and the cavity of decay admits of filling in the usual manner, the proximity of the gold to the "nerve," or the injury caused by the necessary pressure, is sufficient to produce so much irritation of this part as to lead to inflammation and destruction of its vitality. Sometimes no active inflammation supervenes, but the "nerve" gradually loses its vitality without giving any warning that attracts serious attention. The first notice the patient receives of the existence of this state of things is discoloration of the affected tooth, tenderness to pressure, or an active inflammation of the surrounding tissues, resulting in alveolar abscess.

The death or exposure of the "nerve" should always be carefully guarded against. Although the loss of a tooth is by no means a certain consequence of the death of the "nerve," its preservation becomes much more difficult and doubtful after this occurs. It always requires difficult and expensive operations, frequently attended with severe and unavoidable pain. Of this, however, more will be said hereafter.

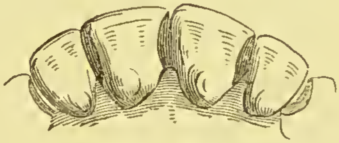
Now, it is obvious that the nearer the "nerve" is to the surface, the more probable is the occurrence of the injurious results referred to. The lateral incisors under consideration, the bicuspid teeth, and the lower incisors, require the most careful attention for this reason.

It is of special importance, for the reason stated, that such teeth should be protected, by all possible means, from any serious loss of substance by the inroads of decay. Although the lateral incisors, if *well* filled as soon as the decay becomes visible through the enamel, may be preserved, it is always better to avoid any risk of the injury explained.

If it is found that decay has made its appearance upon the mesial surfaces of the central incisors previously to the coming of the laterals, it is very strong evidence of the existence of a great tendency of the teeth to decay. It may, therefore, be considered certain that decay will take place, on the surfaces in contact, of the central and lateral incisors soon after the latter take their places. Why should not this be reasonably looked for? The teeth in question of the same individual, as they are formed at the same time, and under the same conditions, as regards health, must be identical in structure. The fluids of the mouth are, of course, of the same character. All the conditions are so nearly identical that the same results must be looked for. This is a case in which there is no possibility of mistake. I am sure, therefore, that I am correct when I say that under the circumstances decay is certain to attack the central and lateral incisor teeth on the surfaces in contact, unless the patient can be induced to take extraordinary care of them. There will not be one exception in fifty cases. Its occurrence is a mere question of time.

In this case, decay of the lateral incisors may be certainly prevented, and one of two things should be done: either to watch them with such great care that the very first appearance of decay is detected, or at once, unless the individual interested can be induced to take great care to prevent decay, to cut away the distal surfaces of the central incisors and the temporary canine teeth, Fig. 27. If this is done as soon as the lateral incisors take their places, and they are subjected to such further treatment as will be described, they will be preserved during life with the enamel perfectly intact.

FIG. 27.



Now, let it be clearly understood that this separation of the incisor teeth is *not advised indiscriminately.* The incisor teeth of every child do not necessarily or inevitably decay. There is a small, but it is a very small, number of individuals who, even at the present day, when the prevalence of decay is so common, pass through life without being subject to decay of the teeth at all; and sometimes, though more rarely, the incisor teeth remain sound during life, while the back teeth are destroyed by decay, commencing on the surfaces in contact. A dentist who is worthy of the name should be able to recognize such cases, and to avoid unnecessary and injurious intermeddling with any of the teeth. I certainly hold myself capable of making this discrimination.

But it must now be carefully borne in mind, as has already been explained, that, after the surfaces of the dentine are exposed, in carrying out the treatment advised, some time is required for the consolidation of the fibrillæ cut through; and until this takes place decay is liable to recur, although not likely if the separated teeth do not again come in contact. At what time this change is completed cannot be stated definitely. It may be in a few months, or not before the lapse of several years. The teeth, therefore, must be examined frequently, as already urged, after having once been separated, until it is ascertained, beyond a doubt, that all tendency to decay has ceased. When the change referred to is complete, the cut surfaces will be found to have acquired a remarkably dense and highly polished appearance, readily recognizable, after having been once examined closely, and may be considered secure for life.

I would here ask those who are interested in this subject (and who are not?) carefully to consider what I propose. It is to save the front teeth from decay by means which obviates the necessity of resorting to operations by which they are often disfigured, which are painful, and not unfrequently fail to accomplish the desired result. The method is so simple that its advantages would appear to be self-evident.

It is somewhat surprising that any person of ordinary intelligence should fail to see the force of this reasoning; but it is amazing that any one who has had even a few years' experience in the practice of dentistry, and familiar with the facts upon which it is based, should not at once see the great advantages of the plan of treatment proposed. Dentists are not, however, exempt from common human infirmities. As in other callings in life, there are but few persons engaged in the practice of dentistry who think independently. Young men have no other light to guide them than the instructions of their preceptors, whose views are generally adopted without question. As they grow older, the common tendency is to fall into routine methods, and to give to all alleged improvements but little attention. New views, therefore, as is always the case, must, necessarily, contend with the lack of thoughtful independence, on the part of younger men, and the settled opinions or prejudices of those who have grown old in the practice of the methods they have been taught. The methods they employ are sufficiently effective to satisfy them, and they do not care to endeavor to ascertain whether the proposed object may not be accomplished by some others in a more perfect manner. Like a certain Frenchman who lived in an English community for a number of years without having made any attempt to learn the language, the French being, in his estimation, as good a language as he wished to know.

I have said and shown that the treatment of superficial decay, described, is effectual for its arrest. But let it be supposed that the operations should not be successful, the exact condition of the surfaces cut away, as described, can be ascertained at any time. If decay should recur, its presence can be detected by a simple examination with a glass. It will only be necessary, then, as a last resort, to fill the decayed places; and this can be done under the most favorable circumstances, and in a manner approved by some of the best practitioners of dentistry who have ever lived, and so as to avoid the slightest disfiguration.

The plan of treatment, therefore, which I have thus far described, furnishes the alternative of escaping altogether the operation of filling the incisor teeth, or of having recourse to it if the first operation of more simple character should fail.

To such an absurd extreme is the reliance upon the operation of "filling" for the arrest of decay of the incisor teeth carried, that, in the face of all the accumulated experience of the dental profession, favorable to the more perfect, desirable, and effective method to which I have recalled attention, it is a common practice quietly to observe the attack of decay without making any attempt to arrest it until cavities are formed to receive gold fillings. People are told that the teeth of their children, or their own, are decayed, but not enough to require attention. It is advised, instead of at once arresting the decay, as can be so readily and effectually done in the manner described, to wait until they are sufficiently decayed to be filled. A great many cases of this nature have come under my notice. I will give the history of one of them.

Miss L——, aged seventeen, was placed in my care for general attention to her teeth. I at once observed that the two central incisors were considerably decayed on the surfaces in contact. The young lady's teeth were not unusually liable to decay. They were of much better structure, indeed, than is usual. On calling the attention of her mother to the condition of the teeth referred to, she assured me that she had always been extremely solicitous about the preservation of her children's teeth, and had taken her daughter, at an early age, to a dentist who had a large practice, and who was reputed to be well acquainted with his profession. He had stated to her, some time before, that decay had commenced in the central incisor teeth, but that it had not gone sufficiently far to render filling necessary. On expressing her anxiety about their final preservation, and asking for some reason for delay, he merely said it was "better to wait." Some six months had elapsed before she was seen by me, and it was then quite difficult to save them without the loss of the "nerves." There is no question that, in this case, the decay had been in progress for at least seven years. Although the teeth of this patient, after certain operations had been performed, had all been pronounced sound a few months previously, it was found necessary, at the time referred to, to fill them in some twenty places. This was a case, too, in which, to the serious injury of the patient, all four of the first permanent molars had been extracted for the purpose of giving the others more room, and thus preventing decay. In this case the teeth had become so sensitive at every point where the decay had penetrated the enamel that the pain attending the necessary operations was of severe character. It taxed the fortitude of the patient fully to bear these operations, which, in some instances, were much less perfectly performed than they would have been but for this obstacle.

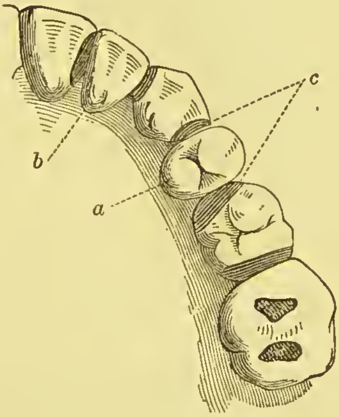
The history of similar cases without number might be related, as they are of everyday occurrence. The dentist who had charge of the patient referred to has a very large practice and the confidence of large numbers of the community in which he lives. There is no question that in a few months the nerves of the teeth referred to would have been exposed, and in the same incompetent hands would eventually have been lost, or so discolored as to disfigure the patient for life. I have many times seen persons, from the same hands, with but few of their teeth remaining, after having undergone repeated painful operations, from childhood up to adult age, for their preservation. Such men are to be found in large numbers engaged in the practice of dentistry everywhere. Is it surprising, therefore, that there should be so much skepticism in regard to the value of dental operations?

VI.

BICUSPID AND MOLAR TEETH.

THE next in order of the permanent teeth are the first bicuspids, Fig. 28, *a*. They come at about the ninth year, and take their places between the remaining temporary molar and canine teeth. The obvious means of protecting these teeth from decay of the surfaces in contact with the temporary teeth is to cut away portions of the latter, as shown in Fig. 28, *c*. The advantages of this simple preventive measure, already successfully employed in the case of the first molar, are so plain that it is difficult to conceive of any objection that can be made to it. With ordinary care on the part of the child under treatment, these teeth will

FIG. 28.*



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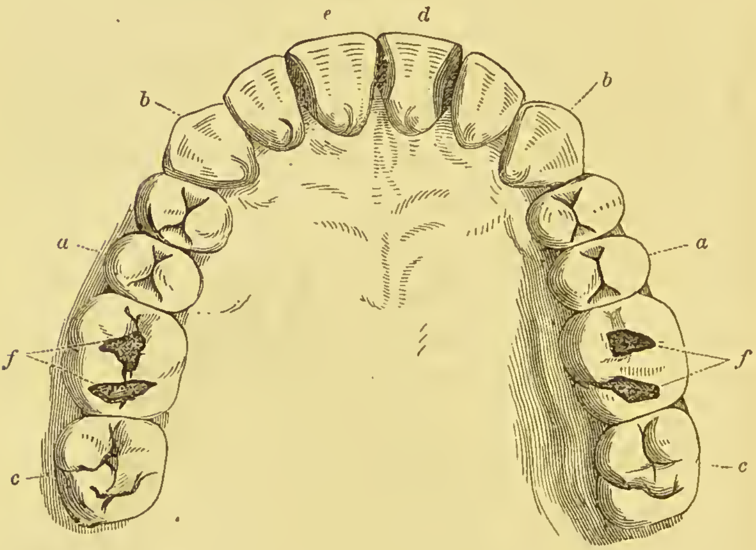
* FIG. 28.—One-half of upper teeth at nine years of age: *a*, first bicuspid; *b*, lateral incisor; *c*, surfaces of temporary canine and molar cut away, as explained.

now be secured from decay of the surfaces referred to until the coming of the second bicuspids.

In the regular process of development of the permanent teeth, the second bicuspids, Fig. 29, *a*, *a*, follow the first; they come at about the eleventh year. In the course of a year afterward, the canine teeth, *b*, *b*, take their places. At about the same time the second molars, *c*, *c*, make their appearance,

FIG. 29.*



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* FIG. 29.—Upper teeth at about the thirteenth year: *a*, *a*, second bicuspids; *b*, *b*, canine teeth; *c*, *c*, second permanent molars; *d*, left central incisor cut away on both sides; *e*, right central, with distal surface cut away from contact with lateral incisor; *f*, *f*, fillings of defective places on grinding surfaces of first molars.

and the permanent set, with the exception of the wisdom teeth, is completed.

It will be apparent from a glance at Fig. 29 that, although so much space has been occupied in the foregoing pages in describing the treatment of the teeth, up to the present period of their development the permanent teeth have been subjected to a remarkably small number of operations. One of the central incisors, *d*, has been separated from its neighbors by a slight cutting away of both proximate surfaces; the other, *e*, has, in the same manner, been separated from the contiguous lateral incisor by cutting away a small portion of the distal surface; and the molar teeth have been filled, on the grinding surfaces, at the points where they were defectively formed. This comprises all the attention, in the way of operations, which has been given to the permanent teeth.

Now, it must be borne in mind that these operations were not in this case performed in anticipation of the occurrence of decay, but to arrest it after an attack had actually commenced. They will be found, when the patient whose teeth have been subjected to this treatment has reached the thirteenth year, to have proved successful.

Can any man in his senses undertake to say, if this simple treatment, as directed to the incisors, is effective for the purpose in view, that it is better that these teeth should remain untouched after they are discovered to be affected by decay, until cavities are formed, which it becomes necessary to fill with gold in order to arrest the advancing disease? It is generally admitted among dentists that this means of arresting slight decay of the incisor teeth is effectual for the purpose, and has been proved, in innumerable instances, to be so; yet, strange as it may seem, some of the very individuals who acknowledge its efficiency for the object in view never resort to it, but continue to pursue the plan of "plugging" all the incisor teeth of the children who come under their care. They do not seem to consider that by means of this simple and effective treatment extremely painful operations and all possible disfiguration are avoided, but go on pursuing the accustomed course, without giving to the matter one single moment's vigorous thought. I cannot leave this part of my subject without still further endeavoring to arouse attention, both on the part of dentists and the public, to the great advantages of the system of treatment explained, when applied to the incisor teeth, as contrasted with the comparatively imperfect character of the common practice. It furnishes not merely a possible method of arresting decay of these teeth, but it is the most direct, the simplest, and the most effective ever devised. As has already been stated, the arrest of slight decay by the means described is not new. It has been practiced for a great many years, and has proved effective in numberless cases. Why it should ever have been abandoned by the more intelligent class of dentists, and in its stead more painful, more difficult, and less effective treatment substituted, is one of those constantly-recurring anomalies in human affairs for which it is impossible fully to account.

The requisite attention for the preservation of the lower teeth, as the change from the temporary to the permanent set progresses, is of similar character to that described. The lower incisor teeth, however, rarely decay, and will be at this time, in most cases, entirely intact. With comparatively few exceptions, they remain sound during life, requiring no attention, except the removal of the tartar from their inner surfaces, upon which it is very liable to form. These teeth, however, should be watched with the same care, during the first year after they are formed, as the upper incisors, and, if they are attacked by decay, it should be detected at the very earliest moment. Decay of these teeth, when slight, can readily be arrested by proper separations, and, for reasons already stated, it is important that it should never be allowed to extend so deeply as to render filling necessary.

The separations required for the removal of superficial decay of these teeth differ from those described as applicable to the upper incisors. The separations are made in a direct line, instead of cutting away greater portions of the lingual surfaces, leaving slight shoulders just above the gums to prevent subsequent contact. In case the decay has progressed so far as to render filling necessary, the cavities must, as a general rule, be filled from the front. With these teeth this is a matter of comparatively little consequence, as they are generally but little shown in ordinary intercourse.

The attention given to the teeth up to the time now reached has been, with the exception of the small number of operations referred to, altogether preventive, and has been mainly directed to the temporary teeth. But these have now passed away, and we have to deal entirely with the permanent teeth.

The period reached is a critical one. It is here that issue is taken with me, as to the further application of the system I am advocating, by those who may be willing to admit its advantages so far as the incisor and canine teeth are concerned.

But the problem must be solved at this time, as the course to be pursued must now be determined upon. The lapse of a single year will, in most cases, render any other than the common course of treatment impossible.

The first question which presents itself is:

What is the liability of the teeth, now under consideration, to decay of the proximate surfaces, as compared with the incisors?

The nature of decay of the teeth has been explained. Whatever may be the active agent in its production, it has been shown that it occurs at those places only where particles of food, or the secretions of the mouth, may be lodged and retained. It has been found, in the case we have been following out, that decay has attacked the incisor teeth on the surfaces in contact shortly after their completion. This early attack of decay, as has been shown, is attributable to two principal causes:

To some general defect in the structure of the affected teeth, or to solvent properties of the secretions of the mouth (for the sake of convenience in the argument, we will suppose the solvent agent to be exclusively in the secretions) to the action of which they are exposed; or, as indeed is commonly the case, to both these causes combined.

The teeth may be fully capable of sustaining the friction to which they are necessarily subjected, and able to resist the action of any solvents to which they are exposed; or they may be comparatively soft, frail, and easily destroyed. As a general rule, all the teeth of any individual are of the same character in regard to structure. The reverse of this is exceptional, and may be attributed to changes from the normal condition of health while the teeth are in process of formation. The teeth are not formed simultaneously. The crowns of the permanent incisor teeth, for instance, are partially formed before there is to be found more than a trace of the second permanent molars. It is readily understood, therefore, that the crowns of the incisor teeth might be defective in structure, in consequence of an attack of illness at the time the crowns were in process of formation, and yet the second molar teeth, formed after recovery from this disordered condition of health, might be very different in character. But there is little difference in the periods at which the formation of the crowns of the teeth, as far back as the first permanent molars, are completed. Without going into this matter with any attempt to be strictly accurate, we find that at about the sixth year, before any of the teeth are shed, the crowns of all the permanent teeth are formed, including, indeed, the second molars.

If there has not been any marked deviation from a condition of ordinary health, it is quite certain that whatever the quality of the structure of the teeth may be, it must be common to them all. Or if, subsequently, from general causes of any kind, either natural or morbid, further changes take place, they will be shared by all alike. Whatever, therefore, the predisposition to decay may be, so far as it is dependent upon the structure of the teeth, it will be the same in all those of any individual who has reached the thirteenth year without a serious attack of illness.

The liability or predisposition of teeth to decay depends, as has just been stated, in a great degree upon their structure. But the hardest and most perfectly formed teeth may be destroyed by decay if the decomposing agent is sufficiently powerful, and those of the softest texture may remain unaffected during a long lifetime, if the agencies to which they are exposed have no solvent power.

Usually, however, the predisposition in the way of imperfect structure and the exciting causes dependent upon the character of the secretions of the mouth are found to exist together. Well-formed teeth and a robust physical frame would seem to imply the best condition of the secretions of the mouth. In a normal state of health the secretions of the mouth should be alkaline, and incapable of causing decay of the teeth. But what is understood by a state of perfect health can be predicated of a comparatively small number of people at the present day. It is, therefore, found that those who are regarded as being in good health are subject to decay of the teeth. The secretions of the mouth of most people indeed, when examined chemically, instead of being found in their normal condition, which is alkaline, exhibit an acid reaction. Differences exist, however, in this respect between different individuals, and there is not only a difference with regard to the secretions of the mouth in different individuals, but in the same individual in different states of health.

In certain disordered conditions of health the secretions of the mouth are unquestionably impaired, and the mucus more abundant, viscid, and acid. In such cases the effect produced by its action upon the teeth becomes quickly apparent.

We are, with this explanation, prepared to consider the case in hand. The fact that decay has attacked the incisor teeth at a very early age is unmistakable evidence that at that time the secretions of the mouth must have been sufficiently acid to cause the decomposition of the affected surfaces. If the child was in its ordinary state of health, we must take it for granted that the effect observed is an indication of the natural character, in this respect, of the secretions of the mouth.

The only change that has taken place at the period we have now reached is that the child is some five years older than when the incisor teeth were attacked, and that all the permanent teeth, with the exception of the last molars, have taken their places. We know that the structure of all the teeth of this child must, unless the incisors were subject to morbid influences at the time of their formation, be identical. Unless the child was in ill health at the time the incisor teeth were attacked by decay, and had now grown healthy, there is, of course, every reason to suppose that the secretions of the mouth are of similar character. Although the change in this respect, independently of conditions of health, may occur, yet we have no reason to suppose it to be common.

The teeth being identical in structure and exposed to the same influences, we have good reason to suppose that they would be equally certain to decay.

There is a feature of the matter which must not be overlooked. It is one of importance. After the teeth are apparently completely formed, they undergo very considerable changes. The roots are not fully formed until several years after the crowns have been performing their destined functions. The enamel undergoes a slight change after it is uncovered, and the dentine grows denser as life advances. It is believed that as people grow older their teeth, as a general rule, are less subject to decay. It is a recognized fact that in proportion to their density the teeth are capable of resisting the action of agents causing decay. But, although I am willing to give the fact I have stated all the weight to which it is entitled, I do not think the change in this respect that has taken place at the time of life now reached will materially affect the result. This progressive hardening of the dentine, however, will be found hereafter to be an important element in the treatment and prevention of decay.

Unless it can be shown that in three or four years an entire change takes place in the character of the secretions of the mouth, I think there are ample reasons for assuming that they are very nearly the same in character in the same individual at thirteen years of age, as when, at the age of nine, they effected the decomposition of the proximate surfaces of the incisor teeth. It cannot be denied that such a change may take place, but there is no reason whatever to believe, when the child has continued in a comparatively uniform state of health, that it is otherwise than exceptional.

If the general physical conditions, upon which the solvent property of the secretions of the mouth depend, could be changed, and their power to decompose phosphate of lime destroyed, decay of the teeth might be prevented in a much more effectual and agreeable manner than by the plan which I am now describing. No means contemplating this object, at all to be relied upon, have yet been proposed.

A striking difference between the incisor teeth and those now under consideration, as regards their liability to decay, is that the latter have larger and broader surfaces than the incisors; these furnish receptacles for the lodgment of greater quantities of extraneous substances, and are therefore really more liable to attacks of decay.

It would seem to be the most obviously reasonable conclusion from this consideration of the matter, that if the incisor teeth decay at an early age, say before the twelfth year, the bicuspid and molar teeth of the same individual, being very nearly the same in structure, and exposed to influences of the same character, will decay at the same places.

But there are certain other considerations not yet referred to, except in a general way, furnishing indications upon which an opinion may be based without probability of error.

It is a recognized fact that physical qualities, as well as mental and moral characteristics, are transmitted from parent to child. The teeth are not exempt from this law of our being, and a dentist may base his estimate of the liability of the teeth of a child to decay, even before the permanent teeth are formed, upon the characteristics exhibited by those of the parents. Even in cases where the teeth of the father and mother differ in structure, as is not uncommon, the child may inherit all its physical qualities from one or the other, and the forms and general appearance of the teeth will resemble those of one or the other of the parents. Their liability to decay may be very certainly determined by their general resemblance to those of either one of the parents.

The general characteristics of the teeth, as regards their structure, furnish indications to a dentist of experience and observation which are not likely to mislead him. The fact that very white, pearly-looking teeth are more liable to decay than those of a more yellowish color is commonly observed. It is found, too, that the dentine is sometimes so dense that it is cut with great difficulty, and again, so soft that it seems to have but little cohesion.

Indications of a reliable character, too, may be drawn from the character of the fluids of the mouth and the condition of the general health, as I have already explained. I would go more fully into this branch of the subject if it were at all necessary, but considerations of this general nature may be laid aside and an appeal made to facts bearing upon the question. These are sufficiently numerous to be conclusive.

There are, unquestionably, some persons who pass through life exempt from decay of the teeth; their teeth either do not decay at all, or so slowly that old age is sometimes reached before it has progressed so far as to attract attention. Some persons pass entirely through a long life without finding it necessary to seek the aid of a dentist. Such instances, at the present day, are, however, rare. As already stated, decay of the teeth is now so prevalent that few persons are exempt from its attacks. The observations of dentists, therefore, furnish reliable information as to the extent and peculiar manifestations of this disease, and from these we may obtain data which will enable us to decide the question now before us.

The tables of Mr. Tomes, already referred to, furnish some important facts bearing upon this question. Of 3000 teeth extracted by him, the following table shows the relative proportions of the different classes. With few exceptions, their extraction was rendered necessary by decay.

Of 3000 teeth extracted, there were:

72	central incisors,
117	lateral “
78	canines,
273	first bicuspids,
434	second “

1124 first molars,
637 second "
265 wisdom teeth.

If this record were taken as representing the exact relative proportions in which the teeth are affected by decay, it would at once settle the point. It shows that the incisor teeth are much less liable to decay than those situated back of them, and now under consideration. The disparity, indeed, is very great. But there are some considerations, not apparent without further attention, to be taken into the account. The tables of Mr. Tomes are merely a record of extractions of the teeth of persons who applied for relief from pain at the hospital in which he attended to the department of dental surgery. No conservative treatment of the teeth was, probably, ever attempted. If decay of the teeth is permitted to go on without any effort to arrest it, losses of the bicuspids and molars will always be much greater than of the incisors. The first molar teeth are quickly lost after they come, and when decay attacks any of the back teeth, their destruction is rapid, and attended with so much pain that relief will naturally be sought in their extraction. The upper incisor teeth of the same individuals suffer, no doubt, from decay, and not in the small proportion represented in the table. They are more accessible, however, and probably more easily relieved when they become painful, by the usual and common applications employed for the purpose. Although the crowns may in time be entirely destroyed by decay, the remaining roots, the nerves having lost their vitality, may occasion no such serious trouble as to render their extraction necessary.

A dentist, however, who devotes himself to the task of the preservation of the natural teeth, has it in his power, if he keeps a record of his cases as they present themselves, of obtaining reliable data. Such records I have kept for twenty years.

I have carefully gone over these records a great many times; they have frequently thrown light upon many points which would otherwise have been obscure, and have enabled me to form exact and reliable views in cases where they would otherwise have been based upon mere recollection, and necessarily vague. After a very careful estimate of the numerous cases examined, I regard the following table as a close approximation to the relative liability of the teeth to decay upon the proximate surfaces when all the usual efforts are made to treat it as it occurs:

TABLE OF 1000 CASES OF DECAY OF PROXIMATE SURFACES.

		Per cent.
Central incisors	121	12·1
Lateral "	90	9·0
Canines	80	8·0
First bicuspids	172	17·2
Second "	156	15·6
First molars	245	24.5
Second "	113	11.3
Wisdom teeth	23	2·3

It appears from this table that the first molar and bicuspid teeth are not only liable to decay of the proximate surfaces, but in a much greater ratio than the incisor and canine teeth. There is one feature about the foregoing table which should be taken into consideration. It is made up of cases of decay occurring in the teeth of both jaws, and as the lower incisors rarely decay, it makes the disproportion greater, between the first molar and the teeth referred to, than would be found if the examination were confined to the upper teeth. This would bring the relative liability of the upper teeth to decay nearer to an equality, with a slight excess in favor of the first molars.

It may be noticed that, notwithstanding the fact well known that the wisdom teeth are subject to rapid decay, the table exhibits but a very small proportion of this class. This is due to the fact that the table was made up, to a great extent, of the cases of young persons who had undergone the necessary treatment before the appearance of these teeth.

I cannot in this treatise go into any closer analysis of the record. This, however, is unnecessary, as it is quite evident, from the data presented, that the bicuspid and molar teeth are more liable to decay than the incisors. I have no hesitation whatever in asserting, and I base my assertion upon careful and extended observation, that when decay attacks the proximate surfaces of the incisor teeth before the twelfth year, so nearly all the bicuspid and molar teeth of the same individual will suffer from decay at the same places, the exceptions will not amount to five per cent.

There is, then, no escape from this conclusion: That so nearly all the teeth situated back of the canines are certain, sooner or later, to decay at some part of the surfaces in contact, if the same surfaces of the incisor teeth are attacked by decay at an early age, that the exceptions are insignificant.

We have, then, to deal with teeth which, with the trifling exceptions noticed, will inevitably decay at some points upon the surfaces in contact.

We come now to a feature of the subject of the greatest importance. The surfaces in contact of the incisor teeth, and also of the canines, are comparatively small. It has been shown how easily they may be thoroughly examined and their exact condition ascertained. But, even if the method described is not adopted, and the usual one of examining them, by means of a small mirror, is relied upon, decay cannot go on to any considerable extent without becoming visible.

Fig. 30.[*]

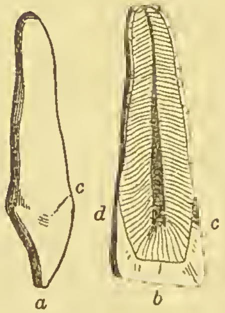

Fig. 30, *a*, represents the mesial surface of an upper central incisor. The point *c* indicates the usual place at which decay commences on the proximate surface of one of these teeth. Fig. 30, *b*, represents a vertical section of the same tooth through this point. From this point the decay makes its way through the enamel, extending but little laterally, and without giving any visible sign of its existence so long as the affected tooth remains in close contact with its neighbor, until the dentine is reached. If the decay is rapid, the discoloration is slight, and greater if it progresses slowly. But in either case, as it extends itself in all directions, its presence soon becomes apparent through the partially transparent enamel upon the surfaces toward the tongue or the lips. As the point *c* is less distant from the nearest surface where it will become visible than it is from the nerve-cavity *d*, there is no danger of the unexpected exposure of the nerve. It is rarely the case that these teeth may not be preserved, even by filling, if the operations are moderately well performed, when the decay first becomes visible at the points referred to. If taken at an early stage of decay, and it is sufficiently early when it first becomes visible at the points indicated, filling these teeth is so far from being difficult that a dentist must be very incompetent indeed in whose hands the loss of one of them occurs, provided, of course, he has entire control of the case. If there were no other difficulties to be encountered in the performance of the operations necessary for the arrest of decay than those attending the treatment of the incisor teeth, even if filling them is relied upon, and provided it is done soon after the attack, the successful practice of dentistry would be a very easy matter. How very imperfectly it is practiced is evident from the fact that these teeth are not unfrequently lost by people who have spared neither expense nor pains to have them preserved, and have employed for the purpose men of professional reputation with the community, and trusted by large numbers of people with the care of their own teeth and those of their children. But while these teeth are generally preserved by men of ordinary ability who exercise a moderate degree of watchfulness over their cases, many, and not unfrequently all, the bicuspid and molar teeth of the same individuals are destroyed. It is very common to find the incisors preserved by filling, and no back teeth left for the important purpose of mastication, except those which were isolated by the extraction of contiguous teeth before decay had commenced. Many persons who read these pages will find this a description of their own experience.

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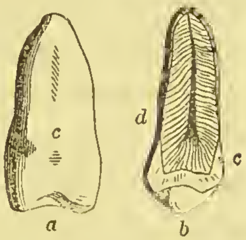
[*] Fig. 30.—*a*, mesial surface; *c*, *c*, point at which decay usually commences; *b*, vertical section through this point; *d*, nerve-cavity.

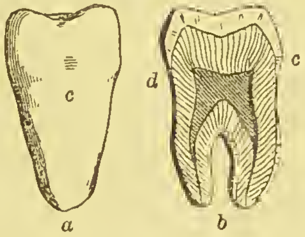
But it will be seen, on a little closer examination, that the teeth we are now considering differ very materially from the incisor teeth. Fig. 31, *a*, represents the distal surface of a bicuspid tooth turned toward the observer; *c*, *c*, is the point at which decay usually commences on this surface; *b*, is a vertical section through this point. The progress of decay here is the same that it is elsewhere: it makes its way directly through the enamel without any very great extension, laterally, upon the surface from the point of attack. As soon as a cavity is formed, the decomposition goes on in every direction, but more rapidly in the dentine when it is reached. The distance from the point *c* to any of the surfaces at which the decay would become visible, is greater than it is to the nerve-cavity *d*. Consequently, as the decay generally extends itself equally in all directions in the dentine, the nerve is in danger of exposure or injury before there are any apparent signs of its existence.

FIG. 31.*



It will be found that the difficulty described is still greater when we come to the molar teeth. This becomes apparent from Fig. 32. Decay on the mesial surface of a lower first molar usually commences at the point *c*. The

FIG. 32.†



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[*] FIG. 31.—*a*, distal surface of second upper bicuspid tooth; *c*, *c*, point at which decay usually commences; *b*, vertical section through this point; *d*, nerve-cavity.

[†] FIG. 32.—*a*, mesial surface of first molar; *c*, *c*, point at which decay usually commences; *b*, vertical section through this point; *d*, nerve-cavity.

decay may, and does, commence at other parts of this surface; but, from a great deal of careful observation, I have, I think, designated the usual point of attack. It will be at once seen that the relation of the nerve to the point of the surface where the decay commences is such that it may be reached before it becomes visible at any point where the affected teeth may be examined in the usual manner. It is very commonly the case that the first notice given of the existence of decay of these teeth is an attack of toothache.

The great obstacle, then, in the way of the preservation of the teeth now under consideration from decay, is the difficulty of detecting its presence sufficiently early after it commences. No matter what system or plan of treatment may be pursued, it is important that its first approaches should be detected. Practically, decay of the molar and bicuspid teeth, at its inception, cannot be detected at the positions indicated by any means now relied upon for the purpose. It is easy, as has been stated, to expose all the surfaces of the incisor teeth to inspection; but this is not the case with the teeth in question. As decay commences on the proximate surfaces, usually, as has been shown, near the gum, very considerable separations are necessary to ascertain the exact condition of this portion of these teeth. They may be forced apart by means of wedges of wood, so as to expose the whole of their surfaces for examination. This, however, becomes very difficult and more or less painful when attempted with the molar teeth, unless the first molars have been extracted. But even after the separations are made, it is often, as I have explained with regard to the incisor teeth, not easy to detect decay until it has made some considerable progress: with these teeth it is much more difficult. This separation, too, must be frequently made to be of any use, as in some cases a few months will be sufficient for the exposure of the nerves of the teeth, which, at the time of an examination, might have been apparently sound. But this kind of examination is really unnecessary in regard to teeth of which, as has been shown, it may be predicted with almost unerring certainty that decay will attack them at these positions soon after they take their places in the mouth.

How decay of these teeth may be most successfully treated will now be carefully considered.

VII.

TREATMENT OF DECAY OF BICUSPID AND MOLAR TEETH.

IT is maintained by one of the most thorough practitioners of dentistry with whom I am acquainted, that decay of the proximate surfaces of the teeth may always be prevented by proper personal attention. The gentleman referred to proposes, instead of attempting operations of any kind, to explain to persons interested that the whole matter lies in their own hands. That if parents will induce their children at the time of life now reached to give their teeth the requisite attention, decay of the bicuspid and molar teeth will never occur at the places where it is most to be feared. He does not consider the fact that decay has already attacked the incisor teeth as any reason for supposing there will be difficulty about preventing decay of the teeth now under consideration, but rather as an effective lesson to guard, subsequently, against the neglect which has led to decay of the incisor teeth. This attention consists, principally, in observing the strictest cleanliness in all respects in regard to them, not only by always brushing them after eating, but by the careful removal of all deposits of any kind that may take place upon the surfaces in contact. This is to be accomplished by the frequently drawing between them of floss-silk, or thread, or any other substance that will accomplish the desired purpose.

There is no question whatever that a great deal may be done in this way. I am satisfied that in many cases decay at the places referred to might be effectually prevented by this kind of care. But while this is admitted, it is obvious that it is extremely difficult to induce young people to follow these directions in such a thorough and systematic manner as to render them effective. There are many cases, too, in which the teeth are so liable to decay that no care of this kind would prove of any material advantage.

However available this plan might be for certain classes of extremely careful people, it must be very clear that it could not be relied upon for the intended purpose by the great mass of those whose teeth are liable to decay.

The only method of preventing decay of the teeth recognized by the dental profession at the present day, except that just referred to, is the extraction of some of the teeth when they stand closely in contact. If the first molars are extracted, there is no reason whatever for the subsequent occurrence of decay on the surfaces toward the places these teeth had occupied, of the second molars and second bicuspids, unless they subsequently come into contact. The second bicuspids, too, will frequently, although by no means uniformly, fall back from contact with the first bicuspids, and the contiguous surfaces of these teeth be thus rendered free from any tendency to decay. So far this is very well. If the teeth in question could maintain these isolated positions, the practice might, if there were not some very serious objections to its general adoption (already pointed out in Section IV.), be considered very good. It would be better to sacrifice four of the teeth than to run the risk of losing many more. I am not surprised that a dentist who finds his attempts to preserve the bicuspid teeth, by filling, unsuccessful, should have recourse to this plan of treatment, but I have always regarded it as unaccountable how men of superior skill, and in a position to command ample remuneration for the most careful services they might render, should, except in very rare cases, feel themselves obliged to sacrifice any of the permanent teeth as the only means of preventing decay of others.

But the method cannot always be relied upon for the accomplishment of this object. I have already called attention to a case in which it failed, page 64, Fig. 15. The molar in this instance was extracted, but the bicuspid next to the space did not change its position. It was saved from decay on the distal surface, but suffered from an attack on the mesial surface, which remained in close contact with the first bicuspid. The fact is that the positions which may be taken by the remaining teeth, after the extraction of the first molars, cannot always be anticipated or regulated, unless more attention is given in the way of movements of the teeth by mechanical means, than will be submitted to, or paid for, by people generally.

But, in many cases, the second molars move forward, and finally take their places in close contact with the second bicuspids, which are forced by them into close contact with their neighbors in front. In a case now in my hands this has occurred. The four first molar teeth had been extracted at an early age, and before the seventeenth year the second molars had all taken their places in contact with the second bicuspids, and all had been attacked by decay on the proximate surfaces. The same result occurred in the case of a younger brother and a sister of this patient. In these cases perfectly sound teeth had been extracted for the prevention of decay of those remaining. I have met with many such instances; they are, indeed, very common.

Now, it becomes apparent that there is one very seriously objectionable feature about this practice, and that is its uncertainty.

It sometimes fails, as I have shown, and instead of any good result being obtained, serious injury is inflicted. If the first molar teeth are extracted, some of the remaining teeth will either continue to occupy their old positions, or fall into contact and decay; this, it will be found in most cases, is the inevitable result.

In this event, unless it is admitted that whenever two teeth are in contact one must be taken out to save the remaining one, other means must be resorted to for the arrest of the decay. If any means can be found effectual for this purpose after the first molar teeth are sacrificed, why should it not be equally so if they are allowed to remain? If decay, attacking any two teeth in contact, can be arrested without sacrificing one of them, why cannot the same treatment be applied to any number?

Why cannot a first molar, if it should be attacked by decay on the mesial surface in contact with the contiguous bicuspid, be saved as well as the second molar, when, in course of time, after the extraction of the first it moves forward, takes its place in contact with the same tooth, and decays at the same place? The same reason, close contact with the bicuspid, which would justify the sacrifice of the first molar, would render imperative the extraction of the second, or the second bicuspid, under the circumstances described. The same reason, indeed, would justify the extraction of every tooth in contact with another, in which decay has occurred, or is likely to occur, on one of the proximate surfaces, provided there is not a space to enable it to be moved away permanently from the contact.

But no one, it is presumed, will be found to follow out the legitimate conclusions which flow from the admission of the necessity of the common practice of extracting the first molar teeth to "give room" to those remaining, in order to prevent them from decaying. Reliance will continue to be placed upon the operation of filling, with gold, the cavities formed by decay. Tomes says that this operation "must be regarded as the *great remedy* by which the disease may be arrested and the defective tooth restored to a state of efficiency."

It has already been explained that when the molar or bicuspid teeth, if they are in close contact, are attacked by decay on the proximate surfaces, it is difficult in its early stages to ascertain their condition. Obtaining access to these surfaces when decay is discovered to be present and it is considered necessary to fill them, is one of the greatest difficulties in the way of the accomplishment of this object.

There are two plans of meeting this difficulty:

1st. To force the affected teeth apart by pressure.

2d. To separate them, permanently, by means of the file, or other suitable instruments.

It is important to the accomplishment of my design that these two methods should be examined and compared.

1st. The method of separating the incisor teeth by pressure has already been explained; it is very easily accomplished. When the attempt is made to separate the teeth now under consideration, it becomes much more difficult, as already stated, especially in case of the molar teeth, if an effort is made to preserve them all. But the difficulty is partly escaped from by the sacrifice of the first molars. The separation then becomes comparatively easy, unless the second molars come forward and take their places closely in contact with the second bicuspids, and the wisdom teeth in contact with the former. The difficulty in such case may be still further obviated by the extraction of some of the remaining teeth. But as I propose to save the entire set of permanent teeth, we must consider the merits of this method when all the teeth occupy their proper positions. Even when all the teeth are retained they can be separated by pressure, but with greater difficulty.

There are two plans of applying pressure: gradually and suddenly—either by means of pieces of india-rubber, or wood, inserted between the teeth and allowed to exert pressure slowly, or by heroically driving a thick wedge of wood between the affected teeth and at once forcing them apart.

After the teeth are pressed apart so as to enable the operator to reach the cavities, and he has filled them, they are allowed to drop back into their old positions. The filled surfaces come again in contact. This, indeed, is considered the great advantage of the practice. No permanent spaces are left, and the natural forms of the teeth are preserved. This would, indeed, be a great advantage if the result could be relied upon. But the surfaces treated are still liable to decay. It is difficult to see why they should not be more so than when they were perfectly sound. The junction between the gold and the dentine, or enamel, certainly furnishes a more favorable condition for an attack of decay than the surface of the perfect enamel. My own observations (and my opportunities of examining the results of this practice have been very extended) have satisfied me that the method is very unreliable. I do not remember a single case, even when the finest operations in this way I have ever seen have been performed, which has been successful. Decay has, sooner or later, recurred. I may have been unfortunate in the cases that have come to my notice, but the above is a correct statement of what I have observed.

There is certainly considerable uncertainty about the result when teeth are filled in this way. If so many unsuccessful cases have come under my own notice, it is obvious that such operations are liable to failure. This, I think, the strongest advocates of this method will admit; the best fillings, indeed, of the proximate surfaces, no matter what method of practice may be adopted, cannot be regarded as absolutely certain to prevent the recurrence of decay. I have known the very best operations to fail from defects about the orifice of the cavity, which escaped detection at the time they were performed. It may be the result, too, of other unavoidable causes. In view of this probability of a recurrence of decay, it is a very serious objection to the plan that the surfaces so treated cannot be subsequently examined unless the teeth are pressed apart, as was done preparatory to the performance of the operations. This objection is a very serious one, for unless it is *certain* that a "filling" will arrest decay, it should be so accessible and exposed that it can readily be inspected at any time. No filling can be relied upon unless this is the case.

It has been gravely proposed to permit these teeth to decay until they are partially destroyed, so that the lost portions can be built out with gold to their original contour. In treating decay of the molars, it has been proposed to exceed the original forms of the teeth, and to allow the gold to extend so far beyond the original cavities, near the grinding surfaces, as to prevent contact, except at these points.

There are several very obvious objections to this method, even if it is granted that it may be successfully practiced. One is, that operations of this kind are very difficult, and but few operators out of the large numbers engaged in the practice of dentistry are capable of performing them; another is, that they must frequently be extremely painful; and a third, that so much time, labor, and skill are necessary for their efficient performance, that they become so expensive as to be entirely out of the reach of the great mass of people.

2d. But even when the only remedy applicable for the arrest of decay of the proximate surfaces of the teeth, now under consideration, is to "fill" them with gold, there is the other method, viz., that of separating them permanently. This method of treatment, as applied to the incisor teeth, has already been explained.

This method has been practiced for many years. It has been proved to be a reliable one of preparing such teeth for "filling." It is the opinion of many of the best men in the dental profession that it is by far the best method. My own experience and observation certainly confirm the correctness of this opinion.*

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* In a letter from Dr. W. H. H. Thackston, of Farmville, Virginia, received about the time the above was written, the following statement occurs:

"I am daily more and more convinced, from what I see of the failures of the very best operations in the way of filling, where decay of the proximate surfaces of the teeth has to be treated, of the value of the *early* and *bold* use of the file. I frequently meet with pearly soft teeth, that I filed freely twenty and twenty-five years ago, sound and good, with texture hardened by time, and the change that occurs in all dental and osseous tissue as we advance in age, with surfaces *shining* and *lustrous* as if some *natural* polishing process had been going on in the mouth during the interval. And, on the other hand, I have to deplore the comparative failure of some of the most perfect and beautiful fillings that cost me hours and days of patient, painstaking labor. I particularly refer to those cases where the teeth were *wedged* apart, carefully and perfectly filled without making a file-scratch upon the proximate surfaces, and then allowed to drop back to their natural positions. Dr. Eleazar Parmly, of New York, paid one such of my cases the

We will suppose, as an illustration of this matter, that two molar teeth are discovered to be decayed on the proximate surfaces. In order to reach the cavities produced by the decay, they must be separated. By the plan now under consideration they are cut apart. The cavities are rendered easily

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compliment of saying it presented the most perfect specimens of proximate filling he had ever seen. And yet, although the patient was an attentive and appreciative one, who was fully instructed and spared no pains in the care of her teeth, decay, after a few years, commenced around the edges of the fillings. I had to file the spaces so that the teeth were permanently separated, and refill all the cavities. This is only one very marked case in my experience. Many, very many others have occurred in my practice and come under my observation.

" The great difficulty I experience in fully carrying out the correct practice of properly separating the teeth is that our people will not, as a general rule, apply in *time* to make the operation available. Since our general impairment of fortune, the rule is to let the teeth alone as long as possible, to save the cost of an operation, so that when a dentist *is* applied to, if he can manage to remove the decay without exposing the nerve, and get a large filling condensed without inducing toothache, he considers himself and his patient fortunate. But, in prosperous communities, where the people are educated up to the proper estimate and value of teeth and the requisite means of preserving them, where children are sent to the dentist semi-annually, or at least annually, to have their teeth examined and properly treated, then there is no question as to the advantages of the almost universal adoption of the file as the very best and most effective means, in the hands of a skillful operator, to arrest and prevent decay on the proximate surfaces, and to preserve for a life use these invaluable organs. I regard a well and judiciously filed proximate surface as of incomparably more value than the most perfect gold filling that the skill of man ever got into a proximate cavity of decay."

accessible, can be filled very nearly as readily as those situated upon the grinding surfaces, provided the filling is done at an early stage of the decay.

Now, the method described has this great and obvious advantage, that the surfaces so exposed either cleanse themselves in the act of mastication, or any particles of food lodged between the teeth so treated may be very easily removed. The exact condition of the fillings and the separated surfaces can also be ascertained at any time. This is so important a feature of such cases that *it has indeed become almost an axiom that no filling can be considered reliable unless every part of it can be readily inspected at any time after its completion.*

If the method explained of separating these teeth is a reliable one for the purpose of arresting decay, even if no attempt is made to do so until it has progressed so far as to render filling necessary, it is important that the decay should be treated at a very early stage of its progress,—the sooner the better. But the principal object of the method of treatment I propose is not to prepare these teeth for filling merely, but to avoid the necessity for the operation altogether. It is not intended merely to arrest slight decay by its removal, but entirely to prevent its occurrence on the proximate surfaces of these teeth. Can this be done?

VIII.

PREVENTION OF DECAY OF THE TEETH.

I HAVE described, in Section IV. of this work, a method of treating superficial decay of the proximate surfaces of the incisor teeth, by means of which the necessity of filling them may be avoided. It was there shown that very considerable portions of these teeth might be cut away, and yet, provided the surfaces so treated were made perfectly smooth and did not again fall into contact, they would be exempt from subsequent attacks of decay.

In the case I have taken as an example, and such cases are constantly under my care, the incisor teeth were attacked by decay soon after taking their places. They were separated in the manner explained and the decay entirely removed. At the age of thirteen, now reached, they will be found to have remained free from a recurrence of the decay. It is evident, from the fact that these teeth were attacked by decay at such an early age, that they are of comparatively frail structure, or that the destructive agents to which they were exposed were active and powerful. Yet, although deprived of enamel for more than five years, there has been no recurrence of decay. They will, no doubt, with ordinary care, remain entirely free from another attack during the usual term of life.

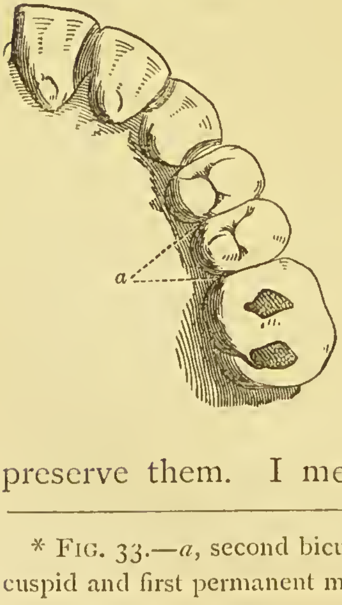
The question then presents itself, Why cannot this treatment, the advantages of which are so obvious, be applied to the bicuspid and molar teeth? They are, in the case of any individual, very nearly the same in structure as the incisor teeth, and the destructive influences to which they are exposed are of the same nature. There seems to be no good reason, therefore, why they should not be preserved by the same means. There are reasons, indeed, why it might be expected to be more effective.

In Section VI. the question of the relative liability of the proximate surfaces of the permanent teeth to decay was examined. It was shown that while they remained in close contact, the molar and bicuspid teeth were more liable to decay than the incisors. In the section devoted to the teeth last named, it was explained that one of the causes of their more frequent decay was the unfavorable circumstances in which they were placed at the time of their coming. There is no question whatever, that if the molar and bicuspid teeth offered no larger surfaces of contact than the incisor teeth, they would, at the age now reached, and subsequently, be much less liable to decay, as the dentine has become denser, as they would be likely to receive more attention, and as the mouth is generally in a more healthy condition after the temporary teeth have passed entirely away. It would seem reasonable, therefore, to suppose that the exposed surfaces of these teeth, after they had been permanently separated, would be less liable to decay than those of the incisor teeth.

It is now necessary to return to that stage of the development of the teeth described at page 109. At that period the first bicuspids had succeeded the temporary teeth, and had been isolated in the manner explained.

The next teeth that make their appearance are the second bicuspids; they are, of course, when completed, in contact on each side with permanent teeth, Fig. 33, *a*. Now, I do not hesitate to assert, not only that these teeth, and those contiguous to them, will certainly be attacked by decay of their proximate surfaces as soon as their crowns come into contact with each other, but that, in less than two years, in the majority of cases, the decay will have progressed so far as to render filling necessary to preserve them. I mean, of course, in such cases

FIG. 33.*



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* FIG. 33.—*a*, second bicuspid in close contact with the first bicuspid and first permanent molar.

as the one I have taken as an example, in which decay of the incisor teeth has shown itself soon after their completion. If this is true, what should be done?

It is the duty of every man engaged in any occupation involving important interests to inform himself thoroughly on all points which tend to increase its efficiency. This is, of course, true of dentistry, which is concerned with very important interests of those who are driven to seek its aid. Any proposed deviation from the common routine of practice should claim the attention of every dentist if it give promise of leading to better results. If it come in such shape as to be likely to give it influence, either for good or evil, he has no right to avoid the most careful investigation of its merits, either to ascertain its claims to confidence, or to discover reasons, if they exist, why it should be condemned and rejected. No other course will meet the responsibility he has assumed.

The question he must now determine is, Will these teeth, if they remain in close contact, be attacked by decay?

In deciding this question, he has no right whatever to ignore the alleged facts, in reference to it, which I have presented. He has no right to reject the conclusions drawn from these facts, unless he can make it clear to himself that they are unwarranted.

If he finds himself compelled to admit that decay is *inevitable* at the positions referred to, or even reasonably certain to occur, then he must at once consider carefully another question which will force itself upon his attention:

What are the *most efficient* means of combating decay of these teeth?

Few persons will undertake to deny the importance of prompt attention in order to secure the best results. I have stated that it is not uncommon to permit teeth to decay until cavities are formed of what is considered the most favorable size to be filled. But such practice, I have said, and repeat, does not admit of defense. It should be condemned without reservation.

Several methods of treating the teeth, at this stage of their development, present themselves:

1st. It is alleged, as I have already stated, that decay may, by proper care, be prevented from attacking the proximate surfaces of these teeth. If this method is considered reliable, it must immediately be put into practice. If it can be made to accomplish the object in view, it is, of course, preferable to any other.

2d. The other method of prevention, usually relied upon, is the extraction of one of these sound teeth. There is no question whatever that if the second bicuspid, Fig. 33, *a*, were extracted, the exposed proximate surfaces of the molar and first bicuspid would be exempt from decay until, in time, they came into contact. Or the large molar might be extracted, and the two bicuspids would either fall away from contact with each other or could be separated by pressure. I have already very fully discussed the merits of this method of treatment.

3d. Little attention, however, is given to any preventive measures, and the means relied upon for the arrest of decay, as I have repeatedly stated, is the operation of filling.

If the dentist who has the case in hand relies upon this remedy exclusively, and considers the best method of obtaining the necessary space that of pressing the teeth apart in the manner described, he can accomplish his object much more perfectly if he take the teeth at such time that, after he reaches the decay, he can give the cavities just what shape he pleases, and has no frail walls to render the success of his operations doubtful. As he objects to filing the teeth, he must ascertain the condition of their proximate surfaces by forcing them apart. This he must do without delay. If he does this in a few weeks after they are formed, he will, in most cases, find some traces of decay. There will probably be no cavities, the enamel may not even be penetrated, but the process of decomposition has commenced, and, unless it is stopped, will result in the destruction of the affected teeth. As he regards the filling of these teeth the only remedy to be applied, he is bound to resort to it soon after the attack occurs. He is aware that if the decay is allowed to progress beyond a certain point, the difficulty of arresting it by filling continually increases. He can find no excuse, therefore, if he should permit decay of these teeth to escape detection until their preservation is jeopardized, or difficult, painful, and very expensive operations have become necessary to preserve them.

If he considers a permanent separation best to accomplish the object of filling these teeth, the sooner this separation is made the better. If he is not satisfied, in the face of all the evidence bearing upon the probabilities of decay of the proximate surfaces of these teeth, that it is certain to occur in such a case as that under consideration, nothing can excuse him if he fails to detect its first approaches. This he can do by no other means than by forcing the teeth apart. He will soon, by an examination of this kind, discover the first softening of the enamel at the affected places. He is well aware that simply cutting away this decomposed spot will not arrest the decay. But a chance is offered him to arrest it, by making just such a separation as he will be compelled to do if he should permit the decay to go on until cavities are formed. He is aware, too, that it is in his power at this time to give the surfaces just such shape as may be best. What possible reason a dentist, who considers this method of filling teeth the best, can offer for delay in making the separation after he has ascertained the actual existence of decay, I cannot conjecture.

I propose, however, to look now, as I have done up to the present stage of the development of the teeth, to preventive measures, and to continue the management of the permanent teeth thus far pursued. But as the temporary teeth have all disappeared, the same object that was accomplished by cutting them away, as explained, must now be attempted with the permanent teeth. We have heretofore relied for the prevention of decay of the bicuspid and molar teeth upon the removal of certain portions of the contiguous temporary teeth. To obtain such a separation, it now becomes necessary to cut away portions of the permanent teeth themselves.

As explained in treating of the incisor teeth, the necessary separations may be made, provided the operation is performed sufficiently early, by cutting away a portion of one of two teeth in contact, so that, like the lateral incisors in the case described, some of them may be left entirely intact. In carrying out this treatment, those teeth should be cut away which can spare the greatest amount of substance without injury. It is evident that in the treatment now to be applied to the bicuspid and molar tooth, the latter should be selected, as it is much larger and can spare all the necessary loss of substance without risk of injury to the nerve. It should, therefore, be cut away as shown in Fig. 34, *a*.

The separation of the two bicuspid teeth should be made by cutting away the mesial surface of the second bicuspid, Fig. 34, *a*, as, by this plan, the first bicuspid may be left entirely intact. The requisite separations may be made without the use of the file. A very effective set of chisels for this purpose has already been described in Section V.

FIG. 34.*

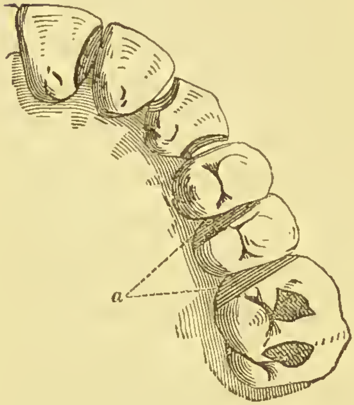
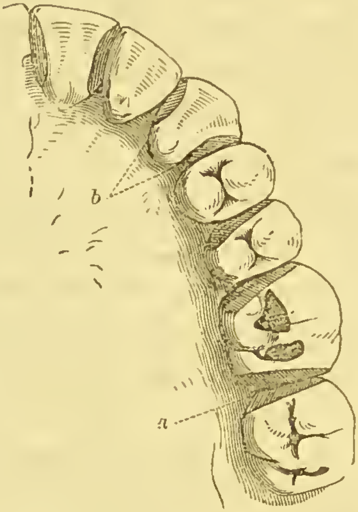


FIG. 35.†



The only temporary teeth now remaining are the canine. As soon as those of the permanent set take their places, they should at once be cut away from contact with the first bicuspid and the lateral incisor, Fig. 35, *b*. I generally prefer this to making the necessary separation by cutting away any portion of the first bicuspid. The latter tooth is, by this means, left entirely intact, and, if no change of the relative positions of the teeth occurs, will, with ordinary care, remain free from decay during life. It will probably, however, be found advisable to remove a small part of the mesial surface of the first bicuspid in order to make the separation more perfect for the accomplishment of the object in view.

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* FIG. 34.—One-half of upper teeth, at about the eleventh year, with molar and bicuspid teeth separated, as described.

† FIG. 35.—One-half of upper teeth, at about the thirteenth year, showing all the operations described.

The second molars come at about the same time. They should at once be separated from the first molars, as shown in Fig. 35, *a*. As these teeth can bear considerable loss of substance without approaching dangerously near to the "nerve," it is better to cut them both away in the manner shown.

When the wisdom teeth make their appearance, they are to be separated in the same manner, if it is considered desirable to preserve them. Often, however, they are small, imperfectly developed, and so difficult to keep thoroughly cleansed that they are very liable to decay, in spite of any amount of attention that may be given to them. When this is the case, it is better that they should be extracted than to subject the patient to repeated painful operations to preserve them. When it is considered necessary to extract them, this should be done promptly. They should never be permitted to remain so long as to lead to decay of the second molars. When, however, they are well developed and have room enough in the jaws, there is no reason why they should not be preserved. In all cases, indeed, when their preservation can be effected desirably, it should be done. When it is determined to attempt to save them, they should be separated from the second molars as soon as they take their places.

This, then, comprises the whole of the treatment I propose for the preservation of the teeth from decay of their proximate surfaces. It will be seen that I do not advise the indiscriminate and almost unlimited filing of the teeth as has been supposed. I have said that this method of treatment is simple: it is so. All the requisite operations are certainly within the capacity of dentists of very moderate ability. But in order to be effective, this treatment demands the exercise of the nicest care, patient labor, and subsequent watchfulness of the most rigid character. No slovenly or hurried attention will suffice. All successful treatment of the teeth, indeed, no matter what plan may be pursued, requires this exercise of care and attention in a much greater degree than is common.

There are several points essential to success in carrying out this system, to which I will now call attention:

1st. The separations must be thorough. No obstruction to the free passage of a piece of thread, or linen, or the tooth-pick, must be permitted to remain. The spaces must be made free *from the* *grinding surfaces to the gums.* The cut surfaces should be in the form of double wedges, with the greatest width of separation at the grinding and lingual margins for the molar and bicuspid teeth, as shown in the illustrations. The teeth may be permitted to touch at some point, but the contact must be so slight as readily to allow the passage, at pleasure, of the substances employed to cleanse them. The surfaces of the separated teeth must, if possible, be rendered plane. *It is essential that they should be thoroughly polished.*

2d. If decay has occurred, and is not entirely removed when the separation is made, and yet has not progressed so far as to render filling necessary, it must be most carefully cut away from the affected surfaces. This is not so readily accomplished as may be supposed, and will frequently be found to demand a great amount of patient labor and the most careful examination of the surfaces under treatment, from step to step of the operations. It must always be kept in mind that if a decomposed portion of the surface treated, no larger than the point of a pin, is allowed to remain, the attempt to arrest the decay will fail. Sometimes the affected part is so nearly the color of the whole surface that it is extremely difficult to distinguish between them. The great difficulty of entirely removing decay, after it once commences, is a very strong reason why it should, if possible, be prevented from occurring. If, as sometimes happens in the process of removing decay, it is found advisable to leave slight depressions in preference to cutting away the whole surfaces, they should be as large and shallow as possible. In such cases decay is more liable to recur; and the places treated, therefore, should be carefully watched and filled, if necessary, when it does recur, if it cannot again be entirely removed.

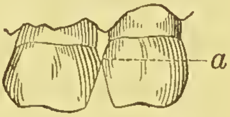
3d. The teeth, after having been separated, are liable, as has already been explained, to change their positions and fall into contact. When this occurs they must again be separated. For this reason it is important that when any of the molar or bicuspid teeth are once separated, they should be examined in less than a month after the operations have been performed. Even in this short time it may become necessary to separate them again. It must be considered imperative that after the teeth are separated the *spaces must be kept free.*

The teeth treated must be cut away at such a bevel as will best enable them to free themselves from particles of food, to render its removal easy, or to prevent subsequent contact.

I have attempted to show, on general grounds, that a permanent separation of the bicuspid and molar teeth is as much to be relied upon for the arrest of superficial decay as when applied to the incisor teeth. It is not exactly true, however, that these teeth can be preserved by this plan of treatment as easily as the incisors. This is a point to which the attention of dentists who may be disposed to attempt this treatment should be directed. They are, indeed, more difficult in many cases to separate permanently. This is due to their shape and the relation in which they stand to each other. This may be illustrated by reference to two contiguous molar teeth.

The crowns of all the teeth, near the termination of the enamel, toward the gum, grow smaller. This is the case in a greater degree with the molar teeth. In two of these teeth, in contact, this diminution of size produces a somewhat triangular space, Fig. 36, *a*, which is, during life, partially occupied by the gum. It is just at the commencement of this space at *a*, Fig. 36, that decay usually begins,—sometimes a little above or below this point; generally above. After the separations are made in the manner explained, and shown by Fig. 36, the teeth will generally touch again at the point *a;* and a little above it, in the triangular space referred to, decay is liable to recur. If they are so separated that the surfaces of contact are very slight in extent, it will be easy to keep them perfectly cleansed, and thus to prevent the recurrence of decay. This portion of the surfaces of separated teeth, however, must be carefully examined at short intervals, after the operations described have been performed, and if decay recurs, must be removed, or, if this cannot

FIG. 36.



be effectually done, filled. It must be observed that the separations made in carrying out this treatment cannot be considered the cause of decay, as all deposits may be more easily removed from the separated surfaces than while they were in close contact, and it is quite certain, in cases of this nature, that decay will occur even if the separations are not made.

It is supposed that the whole of the surfaces of teeth separated artificially will inevitably come into contact again, unless some portion is left. For this reason it is advised to leave a projecting part of the dentine near the gum. But this does not always happen. If all the back teeth are preserved, they are generally retained in their exact positions by the opposing teeth. The second bicuspid, shown in Fig. 15, did not change its position, although the molar tooth back of it had been extracted. This was because of its articulation with the corresponding lower tooth. This occurs constantly when the teeth are separated as proposed. A free space, from the grinding surface to the gum, will often remain through life for this reason. This is an additional reason, of the greatest importance, why the sacrifice of any of the teeth should be avoided, and, as already urged, is a most serious objection to the common practice of sacrificing the first molars.

It should be impressed upon those who have submitted to the treatment I have described, that they have themselves an important part to perform in the preservation of their teeth, and that is, the exercise of the greatest care, especially in early life, and until the separated surfaces become consolidated in the manner explained. The spaces made should be sufficient to permit the free passage of a piece of thin tape. This should be employed several times every day, especially immediately after eating, and passed briskly over the surfaces cut away, so as absolutely to guard against the retention upon them of any extraneous substances. This nice care is necessary after any kind of treatment, and no operator will hold himself in any way responsible for an unfavorable result in the cases of persons who are so careless as not to give proper attention to the cleanliness of their teeth. If the tendency to decay is very great, the dentist, who has the case in charge, should insist upon opportunities of frequent examination, and should direct the patient or the parents to use the tape, charged with prepared chalk, freely every day, and should himself watch the result until all tendency to decay ceases. If the slightest softening of the exposed surfaces is observed, the softened portion must be polished away, the affected places watched with still greater care, and repeatedly polished with oxide of tin.

I have thus explained in detail a plan of managing the teeth, differing very widely from the methods relied upon at the present day for their preservation. It is a method which comes directly into conflict with strong prejudices of the community; and these prejudices are shared, in not an inconsiderable degree, by the dental profession. That these prejudices are strong I have learned by somewhat severe and certainly very vexatious experience to my cost, to such an extent that an imperative sense of duty alone could have impelled me, regardless of such an obstacle, to steadily carry out this practice, after I had become satisfied of its great value. I will now, in a general way, endeavor to show its claims to confidence.

I presume that no attempt will be made to dispute the fact that, by this method, decay of the incisor teeth may be prevented or arrested after an attack has supervened. And if so, I am unable to conceive that it can be for a moment contended that the common method is to be preferred to one so much more simple and effective.

In determining the course best to be pursued for the preservation of the bicuspid and molar teeth, I have made it plain, beyond dispute, that, under certain circumstances, they cannot escape decay of their proximate surfaces. Of this certainty of decay any competent dentist should be able to satisfy himself after taking into consideration the physical characteristics of a child, the condition of its general health, the hereditary liability to decay of its teeth, their structure, the tendency to decay shown, and all the usual indications of decay. These indications are so very plain that decay of these teeth, at the positions referred to, of certain individuals, is *inevitable.* They must then, taking the received view, be filled, sooner or later, as this is the great remedy for decay now recognized. I have explained that many of the best operators, and those longest in practice, are of the opinion that the only reliable means of preparing them for filling, when decay on the proximate surfaces has progressed so far as to render this operation necessary, is first to separate them by filing or other suitable means.

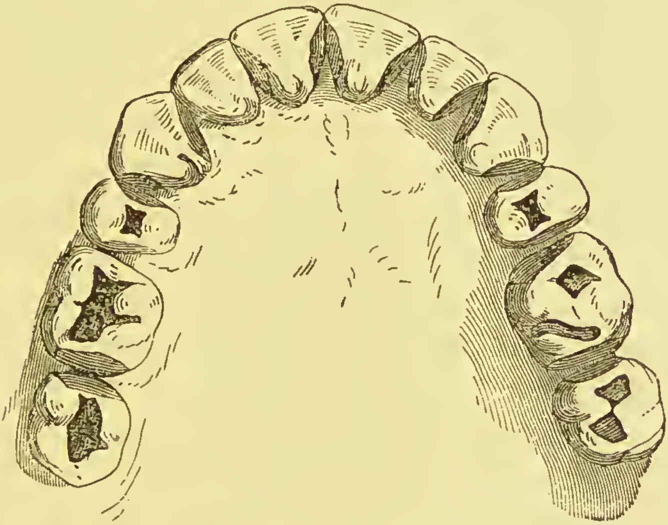
Now, as decay is *certain* to occur (let this fact not be lost sight of) at the places indicated, these teeth must be separated sooner or later in order that they may be effectually filled. If this separation is inevitable,—and it is admitted to be an advantage that it should be made as soon as possible after decay occurs, as it is so difficult to discover at an early period after the attack,—why should it not be done soon enough to prevent the attack, as I have advised?

It has been shown that decay may be, and is, effectually arrested after it has commenced by this means. A case has been shown (Fig. 10) in which it was effectual. If this can be accomplished in one case, why may it not in all, admitting rare exceptions? If slight decay can be *arrested* by its entire removal, and by making a permanent separation, why can it not be *prevented* by the same means? If it is admitted that two teeth in contact will inevitably decay, and that this decay, after it has occurred, can be arrested if they are permanently separated before it has progressed too far to apply this remedy, why may it not be prevented from occurring by a separation of the same character? I am unable to see any good reason why it should not, and I do not hesitate to say that no sufficient reason can be offered.

The great and obvious advantage of the method of treatment proposed is, that it precludes the possibility of decay advancing so far as to endanger the preservation of the affected teeth. It offers the chance of preventing the attack of decay; and even if it should fail to accomplish this object, it exposes the surfaces, certain to be attacked, so that they can, at any time, be examined, and the teeth filled to the best possible advantage, if this should become necessary.

If the system of treatment I have been so earnestly advocating in the foregoing pages were hypothetical merely, it could not be expected, especially as it comes into direct conflict with settled prejudices, that it would be viewed otherwise than with great distrust, however plausible it might appear. But it must be observed that the theory is the result of long experience and extended observation. Although many years since my views tended in this direction, I did not adopt the method hastily but with great caution, watching carefully the results. These have been of the most satisfactory character. Fig. 37 represents a case treated in the manner proposed. The treatment in this case was commenced when the child was about ten years of age. The incisor teeth were all, at that time, slightly decayed, except the right lateral incisor, which is still intact, as the result of its separations. The child was delicate, and the teeth exceedingly frail. Some of the lower bicuspid teeth were left in contact, for some reason which I cannot recollect; they were at once attacked by decay, and are now filled. The extraction of the first upper bicuspids was rendered necessary in consequence of the irregular position of the canines. The remaining teeth came into close contact, with the exception of the left first molar and bicuspid,

FIG. 37.



and were separated when they took their places, as shown in the engraving. The patient is now in her eighteenth year. I see her frequently. All these teeth remain entirely free from decay. What reason is there to suppose that the molar and bicuspid teeth, in this case, would have escaped decay if they had not been separated? Older children of the same family, whose teeth are of precisely similar structure, and in whose cases this treatment was not attempted, have suffered from decay of all these teeth. So rapidly did the decay progress in their cases that some negligence, on the part of the dentist to whom they were intrusted, resulted in the loss of a number of them.

The operations, in this case, were entirely painless. The other members referred to, of the same family, suffered very severely during the performance of the necessary operations. So far from any disfiguration having been occasioned by the treatment, it requires a close examination to discover that they are not perfectly sound. The teeth, both above and below, subserve their uses fully, the separations being the cause of no inconvenience whatever during the act of mastication, or at any other time.

Now, I ask my readers to reflect a little about this case. If decay could be effectually arrested or prevented in this instance, why can it not be in others? Why can it not be in all cases? In this case, although the child was quite as attentive as is common in the care of her teeth, she certainly could not have been induced to take such care as would have prevented decay upon all the surfaces, if they had remained in close contact.

I could, indeed, furnish many similar illustrations of the results of this treatment, quite as successful. I have yet to record a case, of which I have had entire control, in which the result has not been very nearly the same. In some cases decay has attacked molar and bicuspid teeth, treated in this way; but such instances have been comparatively rare, and occurred, generally, in cases in which the decay had already progressed so far that the separations were not made for its prevention. But in these cases of partial failure, the result was incalculably better than it is in forty-nine cases out of fifty of ordinary treatment. The decay was detected soon after its recurrence. In some instances it was removed again, and stopped effectually; in others, small and simple fillings were required, in place of the large and difficult ones that would certainly have been necessary if the separations had not been made, and the common methods relied upon. This is a feature of the matter to which I would invite the earnest attention of the dental profession.

If the teeth can be preserved by this method, no one will undertake to say that it is not better than to permit them to decay so far as to render filling necessary. Every dentist, who desires to do the best in his power for those who intrust themselves to his care, must either adopt it or find some means of determining the exact condition of the surfaces of the teeth in close contact other than those now relied upon. If he can detect decay in its inception, he need not attempt to prevent its occurrence, as its arrest may be accomplished quite as effectually as if the separations were made before it occurred. But he must be extremely careful that his means of examination are reliable, and that he can discover decay at the earliest moment after the attack has commenced. If he delay until the decay has penetrated the enamel and made some impression on the dentine, it always becomes more difficult to arrest it by this means, because it is, as I have already explained, far from being easy to ascertain when it is entirely removed.

In regard to this whole matter, I might be quite willing to concede that the method of separating the teeth, as I have proposed, would fail in every instance in which it is tried, and yet claim that it would be a great advance upon the present method of treating the teeth. If the teeth are separated, as I propose, they can be filled at the earliest moment if decay attacks them, and to the best possible advantage. If dentists who read this book find themselves still unwilling to attempt the preventive system of treatment proposed, let them at least devote their attention to the discovery of some improved means of detecting decay of the teeth, so that their fillings may be of more simple character than those which are now so generally found necessary, or that they may be able to stop the decay by its removal.

And now let us consider some of the objections urged against the method of management of the teeth explained.

1st. The most decided ground of objection is that in carrying out this method it is necessary to separate "sound teeth." One of my oldest and, as an operator, ablest professional friends is so horror-struck at the enormity of such a proposition that, in a letter, he implores me to "consider well" the matter (which has had my earnest attention for more than twenty-five years) before attempting to carry out into practice my views. He can account for my convictions on the ground of "lunacy" alone, and begs me, for the good of our profession and the community, to reconsider the observations and facts upon which I have based my conclusions.

But this objection loses force in face of the fact that the teeth of most children, at the present day, are so frail that although they may be called sound when first formed, they do not remain so after they take their places in contact with each other. It is more than probable—it is quite certain, indeed—that the process of decay commences immediately. This is no strained inference. If the teeth are made up of a substance capable of being decomposed by certain agencies, and under certain conditions, and these exist as soon as they come closely in contact, decay must commence immediately. If a piece of lime is exposed to the action of sulphuric acid, for instance, the process of decomposition commences at once. It is immaterial whether the acid is concentrated or dilute, whether the action is rapid or slow, the instant the two substances are brought into contact the inevitable chemical action begins. This is invariably the case with the teeth. When the secretions of the mouth are acid in character, the act of decomposition commences as soon as the teeth, in due time, take their places, and these secretions are held in contact with certain parts of their surfaces. It may be weeks, or months, or sometimes years, before it makes such progress as to attract attention, but the teeth, in such cases, cannot be considered "sound" twenty-four hours after they are formed. It does not matter whether the decayed point is so small that it cannot be detected with the naked eye, or has destroyed half the affected teeth; in either case the decay is equally present, and in the first, as in the last, will certainly destroy them entirely unless something is done to arrest it.

I have called the system I have proposed a *preventive* one, although it cannot strictly be so considered. The teeth, separated in such a case as I have supposed, are really decayed, but the progress made is so slight that they appear to be sound, and all trace of the decomposition that has occurred is frequently removed by the separation.

What I propose is *the separation of teeth closely in contact, which are of such frail character, and are exposed to such destructive influences, that their decay is inevitable, or has already occurred.*

But I need not dwell at greater length upon this objection, as it has been fully met by the facts already presented and the arguments based upon them.

2d. The disagreeable character of the operation of filing the teeth is, to most persons, a most serious objection to this method of treatment. That it is disagreeable, cannot be denied. To some persons the peculiar sensation produced by the grating of the file upon the teeth is not merely disagreeable, it is almost unendurable. But, in the first place, it must be remembered that, no matter what course of treatment is relied upon for the arrest of decay, this operation cannot be entirely avoided. If the molar or bicuspid teeth are permitted to decay so far as to render filling necessary, it is considered, as I have explained, necessary to separate them permanently, and this is usually done, or partly at least, with the file. In such case, however, the sufferer is not only compelled to endure the disagreeable sensation caused by the filing, but the pain, often of the most excruciating character, of filing or cutting parts which are highly sensitive. This is, of course, entirely avoided if the separations are made before decay has reached the dentine, or progressed so far as to affect its sensibility. If the teeth are pressed apart, and what are called "contour fillings" made, a great deal of filing is necessary to render smooth the rough surfaces of the gold; and this, to many patients, is quite as disagreeable as filing the dentine.

But it is obvious that, by the course of treatment explained, these separations are not made in a short time, but the operations are distributed over several years, and necessarily early in life. It is a fact which no one, with any experience in regard to the matter, has failed to observe, that children are more indifferent to the disagreeable features of the operation referred to than adults. A few months previous to the time at which these sentences are written, I found it necessary to separate two teeth of a child of very timid character, not more than eight years of age. She had shrunk from the slightest pain occasioned by cutting the sensitive portions of the cavities in the crowns of the molars, previously filled, and yet bore the separation with the file—which I then found it necessary to use—of the permanent and temporary teeth, not only without complaint, but with apparent indifference. I have had but little variation from this experience.

But it is not necessary to rely upon the file for the treatment advised. It is found that so much of the proximate surfaces as it is necessary to remove can be cut away with properly shaped chisels, and with but little inconvenience to the patient, as has been explained.

3d. The annoyance and inconvenience experienced during the act of mastication as a consequence of the separations.

The same reason given for the early separation of the teeth, in order to avoid the pain of the operation, applies here also. If the teeth are permitted to decay so far as to require filling, the spaces made are often a source of very great annoyance, as the width and form of the separations must be modified in accordance with the character and extent of the decay. It is often the case, therefore, that the contact of certain kinds of food forced between them, in the act of mastication, produces so much irritation of the gum as to keep it in a constant state of slight inflammation and exalted sensibility. In many instances such teeth, from this cause, become nearly useless. The dentine, too, becomes sensitive as the result of decay, and the contact of anything above or below the temperature of the mouth may give severe pain. But the separations, made at a period so early that they can be rendered great or slight at pleasure, are rarely the cause of any serious annoyance. In regard to this feature of the matter, I have made the most careful inquiry of many persons whose teeth have been preserved by the means described, and the almost universal reply has been that no inconvenience is experienced from this cause. Sometimes, but rarely, complaint has been made, but the difficulty has amounted to mere annoyance.

The exposed dentine sometimes becomes more or less sensitive after it is first exposed, but this is at once relieved by an application of powdered nitrate of silver to the affected surfaces, and after the calcification of the fibrillæ it disappears entirely.

An interesting case, bearing strongly upon the feature of the matter now under consideration, has just come to my notice. It was that of a young man who had, in early life, lost the first lower molar teeth of the left side. The spaces had partially closed up. On the right side the decay had been arrested by separating the teeth as advised. In answer to an inquiry, he stated that, so far from finding the separation of the teeth a source of annoyance, or an interference with the act of mastication, he instinctively avoided the employment of those on the left side, and relied altogether upon the teeth separated artificially.

4th. An objection has been made to the practice on the ground that the grinding surfaces of the molar teeth are diminished injuriously by being cut away. To avoid such a result it is considered better to permit one-third of the affected teeth to be destroyed by decay, so that the lost substance may be built up with gold to the contour of the original sound teeth. It is scarcely necessary to discuss this point, as I suppose no person could be found who would not prefer to have seven-eighths of a tooth remain perfectly sound than to permit a large portion of it to be destroyed, and then to undergo a long, painful, fatiguing, and necessarily expensive operation to restore a part which nature has so well provided, and which may be preserved, as originally formed, with the loss of so small a portion as not to be worth notice. It is a curious fact that there are dentists who insist upon this injurious feature of the method of treatment proposed, and yet do not hesitate to sacrifice the first permanent molar teeth, which have larger grinding surfaces than any other teeth, of every child that comes under their care. In many of these cases, as I have shown, the important uses of the teeth are very seriously impaired by such a course.

The lessening of the grinding surfaces resulting from the treatment advised, is really a matter of no appreciable consequence. It would be better, of course, if the teeth could be preserved for life as nature forms them, but as they are liable to be destroyed by decay, we must resort to the means best calculated to prevent their entire loss. Either the plan I have proposed, or filling them, must be resorted to; and as it has been shown that even if the latter method is relied upon, an artificial separation is necessary, and it must be greater, in most cases, than if the decay is arrested or prevented in the manner proposed.

These are about all the objections of any weight that I have heard urged against the system of treatment proposed.

The advantages to be derived from the preventive treatment of the teeth explained are obvious. By means of this method—

1st. All the teeth may, with very rare exceptions, be preserved.

2d. The requisite operations are of very simple character, and, consequently, less expensive than those commonly relied upon.

3d. All possible disfiguration of the teeth is avoided.

4th. The possibility of the serious consequences frequently resulting from exposure of the "nerve" is avoided.

5th. But a very important feature of the method is that by its adoption all painful operations may be avoided.

The pain attending the preparation of a decayed cavity for filling is a very serious feature of dental operations. There is a great difference in the sensitiveness of decaying dentine in different individuals. Some persons appear to suffer but little from the preparation of a cavity for filling, while to others the cutting away of the dentine causes pain of the most agonizing character. This depends, probably, upon the varying rapidity in the progress of the decomposition of the affected teeth. Sometimes the lime merely is at first decomposed, leaving for a time the fibrillæ unchanged, except that the natural sensibility is greatly exalted by exposure to the irritating influence of agents producing decay. Sometimes the whole of the structure gives way gradually. A recent case is strongly in point. It was that of a lady for whom I found it necessary to fill a small cavity of a lower bicuspid tooth. She was a person of remarkably strong will, and, although she shrank from the first touches of the instrument employed for preparing the cavity, declared her determination to bear what was necessary to be done. I proceeded with the operation, which occupied some ten minutes. The intense suffering she experienced was evinced by her quivering eyelids, general convulsive movements, and nervous exhaustion at the close. That all this suffering might have been avoided is evident from the fact that in other teeth of the same class of the patient in question, decay was effectually arrested by the means I have proposed without having occasioned any pain whatever, and without any further inconvenience than that attending the necessary use of the file which was then employed, but which I should not now use.

A great deal of very earnest effort has been made to discover some agent by means of which this exalted sensibility of the dentine may be destroyed without danger of injury; but although some approaches have been made toward effecting this desirable object, it has not yet been satisfactorily accomplished. Certainly, where time is limited, it cannot yet be done without danger of impairing the vitality of the affected teeth.

If, then, the teeth can be preserved by the means

I propose, and this terrible suffering avoided, this reason alone would be sufficient to give it preference over the ordinary practice.

6th. But there is another consideration of still greater importance than the mere avoidance of pain usually attending what are regarded as necessary dental operations: it is that this painful feature of the usual treatment is frequently found to be an insuperable obstacle to any attention to them. A timid child, who has once suffered the severe torture commonly attending the excavation of a carious cavity preparatory to filling, will be found exceedingly difficult to induce to go through the same ordeal a second time. If the parents have force of character and determination enough—which many have not—to compel the child to submit to pain they would probably not endure themselves, it is impossible, in many such cases, for the dentist, who has the case in charge, to perform the operations, under such difficult circumstances, sufficiently well to be effective. This is one reason very strongly urged for the common sacrifice of the first molar teeth. There are some extremely nervous and delicate children, indeed, who could not be forced to submit to such treatment without risk of serious damage to the general health.

The evil referred to is, unfortunately, not confined to the period of childhood, but I have known many instances (they are occurring daily) of people who, from the lively recollection of their sufferings in childhood, permit their teeth to be entirely destroyed by decay, with all the consequent suffering and injury to health, which is inevitable, rather than submit to dental operations.

If it be true that all the painful features of dental operations may be avoided by any method of treatment, that method must commend itself in an eminent degree if it removes this formidable obstacle to the preservation of the teeth. The plan I have explained does effect this object. If the teeth can be preserved by this method, then its great advantages in this respect must be admitted. When children are convinced, as they soon will be, that they are not to be hurt, this terrible spectre of their early life disappears.

Much more could be said upon this point, but what is said above, though merely suggestive, will, I trust, commend the whole method to the most careful consideration of those who have the charge of children.

IX.

SOME OF THE MORE SERIOUS CONSEQUENCES OF DECAY OF THE TEETH.

I HAVE urged as an important reason in favor of the management of the teeth of children, with reference to decay, as explained in the foregoing pages, that it obviates the severe suffering so commonly attending the simpler operations relied upon for their preservation. The severely painful character of the operation of "filling" teeth for the arrest of decay, even when it is slight, is so well known that most of my readers have, no doubt, had some experience in this way, which will bring the matter vividly enough to their memories.

I have shown, too, that the suffering attendant upon dental operations serves not unfrequently as an insuperable barrier to any attention whatever to them.

But these are by no means the most important reasons why decay should be detected, as soon as possible, after it attacks the teeth. Other and more serious consequences result from neglect of the timely application, or the failure, of such means as may be adopted for the arrest of decay to accomplish the object in view, independently of the injury resulting from the entire loss of the teeth.

I have shown that, in consequence of the forms of the molar and bicuspid teeth, and the relation in which they stand to each other, decay of the proximate surfaces does not usually become visible upon a simple ordinary examination until the nerves are nearly or actually exposed. Whether the plan of preventive treatment I propose meets with approval or not, no one will deny that a dentist cannot rely upon his vision alone to determine the condition, as regards decay, of the proximate surfaces of the molar teeth. He must either be satisfied that decay exists before he can ascertain it with certainty, by any means of examination now known and practiced, or he must run frequent risk of the exposure of the nerve. I do not overlook the fact that these teeth may be separated by pressure, and have already noticed the difficulties attending this plan.

The usual indication that the nerve of a tooth has been reached by decay is more or less pain. The pain is caused by contact with the nerve of substances of an irritating character; and, as it is so delicately formed that it was not intended by nature to be deprived of its hard covering, all external agents are of this character. They may be mild and bland when coming in contact with the skin or mucous membrane of the mouth, but when brought into direct contact with this very sensitive body produce a high degree of irritation, and consequently severe pain. Water, atmospheric air, particles of food, or any of the many substances finding their way into the mouth, will cause pain of greater or less severity when they come in contact with the "nerve." But they also produce an inflammation of the nerve which leads to that species of pain known as "toothache." This is directly caused by the swelling of the "nerve" from an increased flow of blood into it as a consequence of the irritation produced by contact of foreign substances. Its natural sensibility is exalted in this state; and forced, as it is, against the hard, unyielding walls of the cavity in which it is contained, pain of a severe character is produced, too common and well known to require any attempt at description.

As soon as the nerve is exposed, the whole matter is changed. The treatment required for the preservation of the affected tooth is of very different and more complicated character. Even if the usual operation of filling is relied upon for the arrest of decay, it is capable, in most cases, in skillful hands, of accomplishing the object at any time before the nerve is reached, or approached so nearly as to become affected by the proximity of the filling. But when this part once becomes exposed, no substance has yet been discovered which will supply the place of its natural covering of dentine, through the substance of which, indeed, its branches, up to its junction with the enamel, pass. No substance, now known, can be placed in direct contact with it without sooner or later leading to the destruction of its vitality, and to more or less serious consequences.

The only means now known by which a tooth, in the condition described, can be rendered painless and useful is by the entire extirpation of the nerve from its cavity and from its roots.

I am aware that other means have been proposed, and extensively resorted to, of meeting the difficulties of such a case.

One is to place an unyielding cap over the point at which the nerve is exposed, and then to fill the cavity of decay in the usual manner; the cap protecting the nerve from pressure or contact with the filling. It has been alleged that, when this is done, the protected nerve will throw out what is called secondary dentine to fill up the opening made by decay. I do not believe in the method, for the reason that, during a long practice, I have never known one single successful case. I have known such treatment apparently successful for many months, sometimes for years, but eventually leading to trouble, which rendered necessary the removal of the filling, drilling an opening into the cavity, or the extraction of the tooth. I cannot, in a work of this character, undertake to explain the necessary causes of failure of this method. Other methods, resembling this one more or less nearly in character, have been proposed, with no better results. I am aware that this method of treatment is still advocated at the present day; and although I am quite willing to admit that great improvements may yet be made over the method now generally relied upon, I have met with no evidence whatever to convince me that this one has a particle of value. If success has attended this method of treatment in the hands of others, it must be due to some peculiarity of their practice, with which I am entirely unacquainted, and which has not been communicated to the profession at large.

I have said that the treatment of the nerve is difficult and complicated. Notwithstanding this statement, nothing in the way of attention to the teeth appears to be more easy and simple. It is unfortunate for that part of the community anxious for the preservation of the teeth that the temporary relief of toothache should be so easy; if it were more difficult, people would be more anxious to avoid the exposure of the nerves of their teeth.

It was discovered, nearly a half century ago, by Dr. S. Spooner, of Canada; or at least communicated by him to the public, that the vitality of the "nerve" of a tooth might be destroyed by the application of a minute quantity of common white arsenic. The fiftieth part of a grain, or even less than this, if sufficient time is given, will effect this object, at least so far as concerns that portion of the pulp, situated in the crown, which gives rise to ordinary toothache. The relief is so speedy and certain that the exposure of the nerve of a very sensitive tooth is considered the reverse of a disadvantage to persons who have suffered the agony of several attempts to fill the sensitive cavity, which had formed long before the exposure of the nerve. In a few hours after the preparation is applied, the cavity, so extremely painful a short time before, may be cut and filled without any pain whatever, and the patient congratulates himself on his delivery from a state of severe suffering. The affected tooth may be used after the treatment with as much freedom from pain as those which are perfectly sound.

This satisfactory state of things will, however, be found of short duration. It may be, indeed, that some months, or a longer time, may elapse without further trouble, but, sooner or later, serious results are certain to follow.

The effect of the arsenic applied is merely the partial destruction of the vitality of the nerve. The cavity of decay, as has been said, may be closed up with impunity, but underneath the filling is a partially dead and living mass, which gradually becomes affected throughout. The living portion becomes inflamed and eventually suppurates. The pus, as it forms, no matter how small it may be in quantity, having no means of egress, soon begins to exert pressure upon the inflamed and highly sensitive portions of the nerve still retaining vitality.

The irritation gradually extends along the interior of the roots until it reaches the membrane of the socket through the opening at the end of the fang. Almost the first symptom of approaching trouble is some tenderness of the affected tooth to pressure; it appears, too, to be longer than its neighbors and more or less loose. This is due to the swollen condition of the inflamed membranes of the socket. The pain now becomes of the most excruciating character. If nothing is done in the way of relief, the inflammation increases, the parts about the affected tooth swell outside of the socket, the face sometimes becomes enormously enlarged and frightfully distorted. So severe is the condition, which it is quite impossible to describe, that some permanent and serious injury seems inevitable. But after a period of this intense suffering, which may last only a few days, or may continue much longer, relief suddenly comes. The pus forming in the socket gradually makes its way though the bone and escapes in the mouth. This is what is known as a gum-boil. I will hereafter refer to other injurious consequences which may occur as a result, although all present suffering will be found to have passed away.

This is what is generally understood by "destroying the nerve" of a tooth, and the practice is common, I do not say among the best men in the dental profession, but such cases occur every day. But the painful feature which I have described is avoided by a very obvious method. As the severe pain usually results in the first instance from the confinement of the pus in the nerve-cavity, relief is obtained by "drilling" a small hole into the cavity through which the pus can escape. By this means relief is generally obtained, and is for the time complete. This practice is very common, but is condemned, and justly so, by dentists of the best standing for the following reasons:

1st. When an opening into the nerve-cavity is once made for the purpose mentioned, it can rarely be closed again without leading to the recurrence of the painful condition described. After the nerve is partially destroyed, the living portion may retain a kind of morbid vitality for years. I have frequently known a small piece of the threadlike cord in the fang to form and discharge a minute quantity of pus for a great while. As long as this could escape freely, there was no trouble; but in a few days after the closure of the opening, pain would result, and continue with increasing intensity until the obstruction was removed or a gum-boil formed. I have known this state of things to continue as long as ten years, and there is no reason why it might not for indefinite time. This does not always depend upon the suppuration of a small remnant of the "nerve," but it may be due to suppurative inflammation of the membrane of the socket discharging through the root. I cannot, however, undertake any full explanation here, as the scope and design of this work do not admit of it. I shall, at some future time, in a work of different character, go more elaborately into a consideration of this subject. It is quite sufficient for my present purpose to show that if the opening formed by "drilling" a tooth for the relief of pain, caused by a partially-destroyed nerve, is left, it will result in the more or less rapid destruction of the crown of a tooth so treated. Through this opening the fluids of the mouth will gain access to the interior of the crown, which they will gradually destroy. I have recently met with a case in which the incisor teeth of a lady had been preserved for seventeen years by very beautiful fillings by Dr. Elisha Townsend, of Philadelphia, while in other hands nearly all the molar and bicuspid teeth, at that time supposed to be perfectly sound, have been lost in consequence of treatment in the manner described.

2d. Another result of this method of treating the exposed nerve is the discoloration of such teeth. The remaining portion of the nerve gradually becoming decomposed and infiltrating the tubuli, darkens the whole tissue of the dentine. In case of the incisor teeth, this is a serious matter.

I do not say that this method of treating exposed nerves is proper or necessary. It is, indeed, bad practice, and never necessary. I have described it so that any one who may read this book may be made aware of its injurious character, and refuse to permit it to be attempted.

But is a tooth inevitably lost if the nerve becomes exposed? No. The chances are in favor of its preservation, but the treatment is complicated, difficult, and tedious. There is, however, but one method known at present, so far as I am aware, by which this may be accomplished, and that is the entire extirpation of the "nerve" from the crown to the extremity of the root or roots.

The question will be at once asked if the vitality of the teeth so treated is not sacrificed. If this were so, any attempt of this kind would fail, as no substance, once endowed with vitality and then deprived of it, can remain imbedded in living tissue without leading to injurious consequences. The teeth, as explained in Section I., derive their vitality from two sources. The "nerve" supplies that part of each tooth which is uncovered and exposed, and also the interior of the roots. But its connection with the body is maintained by means of the membrane covering the roots. If a tooth is extracted and replaced in the socket, it will become as firm in its place as if it had remained undisturbed. Teeth knocked out by accident are frequently replaced and become fixed in their sockets. In all such cases it may be well to say, in passing, the nerve will be destroyed and must be removed, or the same injurious consequences as above described will ensue, or at least discoloration of the injured teeth will certainly take place.

The proper plan of proceeding, when the nerve becomes exposed, is to destroy its vitality by means of a preparation of arsenious acid, creasote, and morphine, and to take it entirely out of the crown and roots. This may sometimes be accomplished with very little pain in some twenty-four hours after the first application is made, but it will usually consume about two weeks, sometimes longer. The method of conducting this process is known to every competent dentist.

When the nerve has been entirely removed, the roots, or at least the larger ones, are to be carefully filled with gold. The whole process is tedious and sometimes very difficult, requiring necessarily a great deal of time. Very often the vitality of the nerve resists the action of the arsenic, and must either be left to its gradual destruction by time or taken out without regard to the pain inflicted. In such case, as the pain is very severe, it is better to place the patient under the influence of some anæsthetic before attempting so severe an operation. But no attempt should be made to fill a tooth, of which the nerve has become exposed, until the nerve has been entirely removed.

A point I wish to make, however, is, that no matter how carefully the treatment may be conducted and carried out, the result, after the "nerve" of a tooth becomes exposed, is uncertain. If the treatment is thorough, as now generally understood in the dental profession, it should always be undertaken. But the result cannot be certainly predicted, as it frequently depends upon causes entirely independent of the local elements of the case. But no man in the dental profession, who has the care of a child, sent to him as he requires, can be free from blame if he ever permits the nerve of a permanent tooth to become exposed.

But, unfortunately, the injuries sometimes resulting from the exposure of the nerve are of much more serious character than such as I have been imperfectly describing. I will refer, briefly, to some of them.

The occurrence of an ordinary gum-boil, as it is called, is frequently preceded by a great deal of pain, but after it is once formed, and discharges, no further trouble usually occurs; that is, provided the opening occurs inside the mouth and upon the gum.

But although generally a very simple matter, the abscess or gum-boil may lead to very injurious results. A case recently came to my notice, although not under my care, which furnishes a very striking illustration. Quite a young lady was attacked in the evening with toothache in one of the lower wisdom teeth. Some palliative was applied, but the next morning the inflammation had extended to the joint, and the jaws were fast closed. The result was that, after a great deal of suffering, the abscess pointed externally, and finally discharged on the lower part of the face, leaving a scar of very unsightly character, which will disfigure this individual for life.

When one of the upper teeth is the cause of diseased action, the resulting abscess sometimes breaks into a cavity of the upper jaw and leads to very serious consequences.

The eyes are sometimes very seriously affected from the effects of teeth partially deprived of vitality.

But it is not my intention to attempt to enumerate the many very serious forms of disease which may be traced to the teeth, and all of which may be avoided by timely attention to them.

There is one complaint of which they are frequently an exciting cause, and from which the most severe suffering is experienced. I mean what is generally known as "*neuralgia*."

Without attempting to explain the nature of this often obscure, and, at times, incurable disease, it may be said that it is sometimes due to such a condition of the nervous system that very trifling local causes of irritation will bring on an attack. There is no more common cause of facial neuralgia than some morbid condition of the teeth. I have met with many such cases. A short time since a lady, whose general system had been very much depressed by nursing a near relative, who was ill for a long time and finally died, was attacked with facial neuralgia. The attack continued six months, during the whole of which time she was under medical treatment without relief. When she had become almost insane from severe suffering and loss of sleep, she determined to have her teeth examined, as being possibly concerned in her trouble. It was found that the local cause of irritation which had led to all this agony was one of her teeth, the extraction of which at once relieved her. If it had been taken out six months previously, the relief would have been as immediate and as complete. I have met with a number of cases very similar in character.

Neuralgia of the face, however, does not, by any means, always depend upon the teeth, although, as I have said, they are a common exciting cause. It is frequently due to some disordered condition of the general system, and may manifest itself in nerves distributed to teeth perfectly sound. Their extraction in such case will do no good whatever. I have known the teeth to be sacrificed in the most reckless manner in this way without a particle of relief. A competent dentist will be able to discriminate in such cases, and turn his patient over to a physician.

It is not in my power even to glance further at the serious injury which very commonly results directly from disordered conditions of the teeth. I have shown that such injury is liable to occur if the usual methods of treatment of decay are relied upon. I do not pretend to say that these results are liable to occur in the hands of a thoroughly competent dentist, but if he relies upon the ordinary methods of detecting decay of the molar and bicuspid teeth, he will find his patients suffering from the consequences of exposed nerves when he does not suspect the existence of decay; or will deplore the frequent loss of vitality of teeth he has filled with great care, from the proximity of the fillings to the "nerve."

X.

ADVANCED VIEWS.

THE method described in the foregoing pages, of managing the teeth in early life with reference to caries of the proximate surfaces, is based upon the fact that one of the most important predisposing causes of caries of these surfaces is their close proximity. The principle of this method consists in their permanent though partial isolation. This isolation is effected by the excision of certain portions of contiguous teeth. This plan is employed as a remedy for this disorder at a certain stage of its progress or as a prophylactic measure.

I have not laid any claim, as has been intimated, to having originated the treatment of superficial caries of these surfaces by its simple excision, or by what is understood as the permanent artificial separation of contiguous teeth. This method was, as I have stated, effectively practiced many years ago, and is recognized (although its great importance appears to have been under-estimated) by writers upon the subject, at the present day, as one of the means of arresting superficial caries. I have, however, attempted to show:

1st. That although confined in former years almost exclusively to the incisor and canine teeth, this plan of treatment might, with advantage, be extended to all classes of teeth.

2d. I have also attempted to arouse attention to the importance of the fact that in civilized communities, at the present time, caries of the proximate surfaces of the teeth is so nearly universal that the exceptions are inconsiderable.

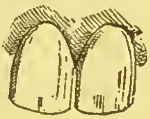
3d. I have urged, as of the highest practical importance, the fact that the process of decomposition of the proximate surfaces, when there is the usual tendency to caries, commences as soon as the fully-formed crowns of the teeth take their natural positions in contact with each other.

4th. I have also called attention to the great importance of employing means of arresting caries in the earliest stages, or, when it is discovered to be inevitable, of advising and adopting prophylactic measures.

5th. I have endeavored to establish a definite basis for determining the existence of caries of the proximate surfaces, before it becomes apparent to an ordinary visual inspection; and have described the conditions which render it certain, in any given case, that caries will attack these surfaces of all the teeth except the lower incisors.

With regard to the treatment of the incisor teeth, I have little to add to what will be found in Section V. The method of treatment described I have always found effective when resorted to sufficiently early. So generally is this treatment successful, that I have come to consider fillings in the front teeth as inexcusable on the part of a dentist who has had the unrestricted care of a patient from childhood. There may be exceptional cases, but they are very rare.

FIG. 38.



With regard to the incisor teeth, very slight separations, when the caries is confined to the surface of the enamel, ought to be sufficient to arrest it, and may probably be preferable to the plan of separation I have described. This separation may be of the character, in a very modified form, of that shown by Fig. 20. It might be made so slight (Fig. 38) as not to disfigure the teeth separated.

I am not at present prepared to advise the change suggested, but consider it well worth attention and trial under favorable circumstances.

What I propose further to say, in this short addition, will have especial reference to the bicuspid and molar teeth. In the treatment of superficial caries of the proximate surfaces of these teeth, I have proposed to make free separations from the grinding surfaces up to the gum. The separation was advised to be made in the form of a wedge. At the apex of the wedge, as this was the most prominent part of the separated surfaces, there was necessarily a narrow line of contact, the teeth falling together after the slight separation made.

The projecting portions were intended to keep separated the surfaces below the part referred to.* The teeth were also intended to be kept by the contact of these small portions from changing their natural positions in relation to each other after having been separated.

It was supposed that, as the area of the surfaces remaining permanently in contact was comparatively very small, this part of the teeth, as well as the portions more widely separated, would remain free from caries, or that a recurrence could be prevented by a comparatively slight amount of attention on the part of the person concerned; this attention consisting, in addition to the usual method of cleansing the teeth, of passing frequently through the free spaces a piece of thread, floss-silk, or similar substance.

The parts in slight contact formed no obstacle to the passage of the agent employed to keep the separated surfaces cleansed. It was believed, and experience has, to a great extent, proved the truth of this opinion, that, to state the matter simply, if such substances as find their way into, or are formed in the mouth, and are capable of feeble chemical action when in contact with the teeth, could be prevented from remaining for any considerable length of time in positions in which they happened to be lodged, caries would not occur. It was also believed that superficial caries, if entirely removed from the permanently separated surfaces, would not recur; or that, if the separations were made sufficiently early, an attack of caries would be prevented.

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* In order to avoid repetition, I shall designate the parts of the separated surfaces toward the gum as "above," whether the reference is made to the teeth of the upper or lower maxilla.

The kind of separation advised in the foregoing part of this work was regarded as best suited for the accomplishment of the object aimed at, and the separation up to the gum, although very slight at the upper part, was insisted upon as essential.

It should be stated, that in all methods heretofore advised, of preventing caries of the proximate surfaces by the personal attention of the individual interested, the passage of some substance between the teeth from the grinding or cutting surfaces to the gum was considered indispensable. This idea was extended, with some exceptions, to all cases in which permanent separations were made for the removal of superficial caries, and a free separation to the gum, however slight it might be, was regarded as requisite. By many practitioners such a separation has been and is considered essential to the success of fillings upon the proximate surfaces. This idea, I must admit, had an undue influence upon my study of the subject, and materially colored my views as presented in the foregoing treatise. But while I claim that the system explained has proved to be remarkably effective when faithfully applied, certain defects of detail have become apparent, and have been found to interfere with its unvarying effectiveness. These defects have been noticed by others, and certainly have not escaped my attention. The principal of these objections I will now notice briefly in the following order:

1st. Sensitiveness of separated surfaces.

2d. Irritation of the gum between separated surfaces.

3. Recurrence of caries.

1st. Sensitiveness of separated surfaces. This difficulty was at times encountered by the author when the dentine became exposed long before the publication of the foregoing treatise, and attention was called to it (*ante*, page 171).

Persistent sensitiveness occurred in exceptional cases only. If the carious parts were entirely removed, and the disease did not recur, this sensitiveness of the dentine, at first somewhat exalted, disappeared very quickly, and could at once be removed, if found troublesome, by an application of some active caustic. Pulverized nitrate of silver applied directly to the sensitive surface is generally sufficient for the purpose.

No greater sensitiveness presented itself upon the surfaces treated as described, with very few exceptions, than occurred after the filling of a sensitive cavity. If, however, caries is not arrested, or the attack renewed, the sensitiveness is persistent, and should lead to the most careful scrutiny of the part affected. The removal of this difficulty should be considered essential to the preservation of the teeth treated.

2d. Inconvenience and suffering resulting from irritation of the gum, caused by solid particles of food being forced between the teeth during mastication.

When this does occur, it is a very serious difficulty, but it is by no means, as has been alleged, a necessary or frequent result of the treatment proposed. Such a separation as I have described, if made sufficiently early, leaves no such spaces as will lead to the difficulty stated. But if the caries has been allowed to proceed beyond a certain stage, any separation that will accomplish the removal of the caries will place the separated teeth in the condition complained of. This is at times unavoidable, no matter what the object of the separation may be, but is by no means a defect attaching itself exclusively to this system of treatment.

3d. Recurrence of caries.

The third difficulty is, of course, the most important, and is probably generally due to the imperfect removal of the caries when this treatment is attempted.

In general practice the separations are not usually, although they should be, made until the caries has advanced to a greater or less extent into the dentine. When this is the case, the entire removal of the carious portion is by no means an easy matter. It is frequently so difficult to determine when the last trace of caries is removed, that the result alone will determine whether or not this has been fully accomplished. I need scarcely say that, if there is any deficiency in this respect, that if the slightest carious point is left, there will not be even a temporary arrest of the caries. To this cause must undoubtedly be attributed the recurrence of caries in many cases after the teeth have been separated for its arrest.

But even after every trace of caries is removed from the part originally attacked, it may, and does sometimes recur, independently of any changes of position or neglect to remove the carious part, as a result of the lodgment and retention of foreign substances between the separated teeth. So far as the system described fails in averting this result, it imperfectly accomplishes the intended purpose.

The separations described in the work appear to be sufficiently large, and of such a character as to be self-cleansing, but they have, it must be admitted, an inherent defect, and this consists in their wedge shape. From the nature of such a separation a portion of it must be so narrow as to favor the retention of foreign substances when accidentally forced into and lodged in the places referred to. Their removal is greatly favored by the small area of contact, and it is only in cases of extreme tendency to caries that it recurs. Their removal, if the patient is careful, is sufficiently easy, and in most cases would prevent the renewal of the attack; but the necessity of this personal attention is unquestionably, to the extent that it is required, a defect in any system of treating dental caries. Besides the lodgment of particles of food in spaces of the form described, it is conceivable that, during the night especially, even if the spaces are well cleansed at other times, the buccal fluids might be retained by capillary attraction long enough to undergo decomposition, between two surfaces in such close proximity, as these might be just below the line of contact at the precise position at which their divergence commences. But I shall presently have occasion to refer more particularly to this feature, and what I shall then have to say will be found to throw additional light upon the subject.

Experience and very careful study of results have led to a clearer comprehension of the whole subject. Modifications have suggested themselves in details of the treatment proposed, nearly, if not entirely, obviating the difficulties stated.

Although the idea of prevention is strongly urged in the foregoing treatise, the principal part of the work is occupied with the consideration of the treatment of caries of the proximate surfaces after it has advanced into the dentine. I now propose to consider caries at a much earlier stage of the attack. The most effective treatment of caries of the proximate surfaces of the teeth renders necessary the careful study of its earliest manifestations.

This is a feature of the matter which has not yet received the attention demanded by its importance. I can at present refer to it but briefly, hoping at some future time to treat this portion of the subject more fully.

The general form of the proximate surfaces of the teeth is irregularly convex, with some flattening at and about the parts in contact. As a result of this convex shape, the interstices near the portions in actual contact must be more or less acutely wedge-shaped (Figs. 39, 40, *a*). In close proximity to the parts in contact the wedge-shaped interstices are necessarily very restricted, enlarging more or less rapidly as they recede from these parts. Near the parts in actual contact the interstices are so small as to be, to some extent, capillary. I call special attention to this point as one of importance.

FIG. 39.

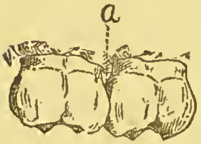
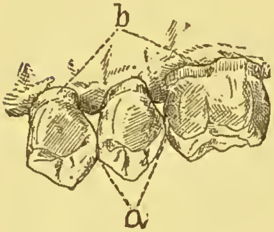
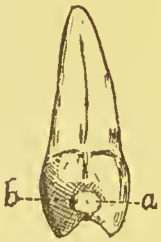


FIG. 40.



The part, somewhat arbitrarily designated the neck of the tooth, is that portion (Fig. 40, *b*) between the upper line of the termination of the enamel and the lower border of the alveolar process. The space between the upper parts of any two contiguous teeth and the alveolus is somewhat triangular in shape. With the exception of the extreme lower part, this space is filled up, during life, with the gum. Neither the surfaces bounding this space, nor the necks of the teeth, are commonly affected by caries when the gum is in normal condition. The buccal and labial surfaces, however, as is well known, frequently become carious, when the gum recedes, so as to expose this part. There are many considerations with reference to this point to which, as not having a direct bearing upon my subject, I cannot now refer.

FIG. 41.



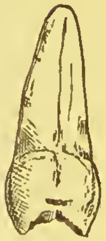
Caries of the proximate surfaces must occur then somewhere between the triangular spaces described and the grinding surfaces. As a general rule, caries does not attack those parts of the proximate surfaces which are in actual contact. When the dental arch is unbroken, the buccal fluids, particles of food, or other extraneous substances which are regarded as factors of caries, do not usually obtain a lodgment between those parts of the teeth which are in close contact. Even when this does happen, slight movements of the teeth occurring during the performance of their ordinary uses appear to displace or render such material harmless. It is probable that such substances do not remain undisturbed in this position, even if they should find their way into it and remain sufficiently long to undergo the changes which render them capable of decomposing the enamel. Fig. 41 represents the mesial surface of an upper bicuspid, from a subject about thirty-five years of age. It will be seen that a distinct facet, *a*, is worn away at the most prominent part, which has remained sound, and is readily distinguished from the adjacent enamel. A fanciful hypothesis has been advanced that caries of the proximate surfaces is due to the breaking down by pressure of the enamel of the teeth in contact. This is a fallacy.

It will be seen, however (Fig. 41, *b*), that while the most prominent portion of the surface, although worn away to a considerable extent, is apparently sound, slight caries has made its appearance on one side of the facet. This represents what, probably, as a general rule, occurs in caries of the proximate surfaces. The attack commences at some part of the capillary wedge-shaped interstices near the most prominent parts. This may be at any portion of these interstices, either above, below, or at the sides of the portion represented by the facet. Caries occurring at the positions designated is, most probably, due to the lodgment and undisturbed retention in these restricted spaces of substances capable, under such circumstances, of producing caries.

It may be supposed that these interstices at some parts will be kept freer from the retention of extraneous substances than at others, as towards the interior of the mouth and opposite the openings of the salivary ducts.

It may be observed that caries is, *ceteris paribus*, likely to attack the proximate surfaces in proportion to their contact with adjacent teeth, and that in proportion to the convexity of two contiguous surfaces (in which case the area of contact is diminished) is their probable exemption from caries. For this reason the proximate surfaces of the teeth shown in Fig. 39 would be more liable to an attack of caries than those represented by Fig. 40. The inferior incisors, not merely from convexity of form, but from the small area of contact, furnish, in some particulars, an example of this fact, although their usual exemption from caries is not entirely due to this condition. It might be inferred that if those portions of the proximate surfaces directly in contact were not liable to be attacked by caries, the liability to this affection would be less in proportion to the extent of the contact. The reverse, however, is true; but this may be explained by the fact that, when small portions, only, of two proximate surfaces are in contact, the obstruction to the removal of extraneous substances from all parts of these surfaces is lessened, as a consequence of the comparative ease with which movements of the saliva take place, or of the action of fluids taken into the mouth, and the usual efforts to keep the parts in a state of cleanliness. The correctness of this view becomes highly probable when we examine a little more closely the earliest manifestations of caries. Fig.

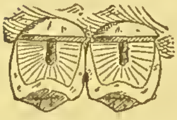
FIG. 42.



42 represents the mesial surface of a superior bicuspid tooth slightly carious near the grinding surface.

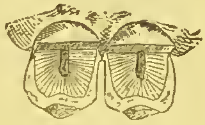
Fig. 43 represents a section through the carious portions of two contiguous bicuspid teeth, affected to the extent indicated. It is seen that the caries represented in these figures is situated in the wedge-shaped interval described, below and very near to the most prominent portions. It is obvious that in this instance the attack has occurred at the most restricted part of this wedge-shaped interstice. In such a case as this, which is a typical one, the condition essential to the development of caries is such a relation of the two contiguous surfaces that agents capable of decomposing the enamel are lodged and retained between them. The capillary closeness of the space is unquestionably the predisposing condition to the attack of caries in the case described.

FIG. 43.



If the narrowest part of the wedge-shaped interval is enlarged to a certain extent, up to the parts in close contact, the condition which we have supposed to be the predisposing cause of caries in such cases is at once and effectually changed. The permanent separation of these two surfaces would effect this object. This is apparently a mere repetition of what constitutes the subject of the greater part of this treatise. I wish, however, to urge more strongly the consideration of the fact that the most effective application of the remedy of separation is, at the earliest period of the attack, before the enamel has been destroyed at the affected part. The case just described is one in which, if the views I have offered are correct, the value of the remedy proposed is forced upon the attention. The extent and character of the separation required to effect the proposed object is shown in Fig. 44. This, it will be perceived, is very slight, and does not extend into the triangular space, although it is carried as nearly to it as it is possible to do without entering it. It will be observed, too, that the upper part of the separation is bold and entirely free from any interval in which extraneous substances can be retained for any great length of time. This separation for the treatment of such an attack of caries as that under consideration need not be carried farther than is necessary to enlarge the interstice in which it occurred below the most prominent parts. But, in most cases, it is better to carry the separation as far as shown in Fig. 44, in order, for the reasons stated, to reduce the surfaces of contact to the smallest possible dimensions. By such a separation all the wedge-shaped interstices of the teeth under treatment are removed, except that situated at the lower portion of the triangular space (Fig. 40, *a*). This separation is in strict accordance with the principles of treat-

FIG. 44.

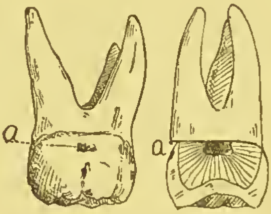


ment stated, and effectually removes the condition upon which the development of caries depends from every part of the surfaces under treatment, except the part just referred to.

These first manifestations of caries of the proximate surfaces of the teeth are rightly considered of paramount importance with regard to the whole subject of their preservation. It must always be borne in mind—and this fact cannot be too strongly urged—that, whatever phases it may assume in its subsequent progress, the commencement of the attack, so far as the proximate surfaces are concerned, is invariably upon the surface of the enamel.

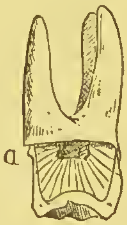
It will be perceived that this treatment consists in the removal, with the caries, of a slight portion of the enamel of the two contiguous teeth. The enamel, however, is not entirely cut away from any part of the affected surfaces. The relation of the teeth toward each other is not disturbed, except to so small an extent that they cannot alter their positions. The surfaces naturally in contact remain unchanged, with the exception of the removal of a small portion of each. Caries of the surfaces named of these teeth commences, in the great majority of cases (although the positions may vary somewhat from that shown in Figs. 42 and 43), at parts of the proximate surfaces admitting precisely this simple treatment. The attack of caries may not commence at the exact place shown, but if it is at any part of the proximate surfaces other than the interval above the prominent portion, precisely the treatment described is applicable. But the attack sometimes commences above the most prominent part (Fig. 45, *a*, *a*), in or very near the lower portion of the triangular space above described. This part of the triangular space close to the most prominent portions presents the conditions constituting the predisposing causes explained, although caries does not probably occur so frequently at this place as at other points.

FIG. 45.*



The same species of separation as that just described is now indicated, but there are some points with regard to it which render it somewhat different. The carious part may be cut away (Fig. 46, *a*) precisely as shown at Fig. 44, but it renders necessary the removal of the prominent parts of the affected surfaces, so that new parts, after the separation is made, fall together. But these new parts of contact will be enamel surfaces with their natural conditions undisturbed. After the separation is made, and the new relations of

FIG. 46.



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* FIG. 45, *a*.—Distal surface of first upper molar, right side, with small spot of caries; second figure *a*, vertical section through the carious portion.

the parts have taken place, it must be conceded that the conditions which led to the first attack are materially changed. The surfaces in contact are reduced to such small dimensions, that, for reasons stated, we should expect them to remain entirely free from the lodgment and retention of extraneous substances. The triangular space has been slightly opened, but the falling together of the teeth will restore them very nearly to their original condition, and protect this space from the access of foreign substances. Even in this case, although a wider separation is made, or, rather, the removal of more of the proximate surfaces is required, it will be seen that the enamel is not entirely cut through at any part.

The treatment described is so simple that no special appliances are necessary to effect the object in view. A common separating file or a simple flat disk will fully answer the required purpose. No special instructions are necessary. The simplest description of the treatment is sufficient to render plain to any dentist of experience the exact course to be pursued.

It is difficult to imagine any serious objection to the treatment proposed at this stage of the progress of the attack of caries in such cases as those described. The separation is so easily made, that, as a dental operation, it is one of the simplest character. There can be no pain attending this kind of treatment, or subsequent sensitiveness of the surfaces cut away, as the dentine is not exposed. There can be no subsequent injury to the gum, as there is no opening to it. There is absolutely no disfiguration of the incisor and bicuspid teeth; so little of the tooth-substance is removed that no subsequent change of the relations of the teeth toward each other is at all likely to occur, and the separation must consequently be permanent. It is scarcely possible that caries can recur, as the condition upon which it is dependent has been entirely changed to a new one, in which the known elements necessary to the production of caries do not exist. If it should possibly recur, it will progress slowly, and will be discovered upon slight examination as soon as it makes its appearance. The separated surfaces can be seen at any time, and the surfaces within the triangular space can be easily reached with a small instrument, thus placing all parts of the teeth in such condition that they can at any time be easily and thoroughly examined.

If caries of the proximate surfaces of the teeth could be detected at its inception, and treated in the manner described, before it has passed through the enamel, it would offer no greater obstacles in the way of its arrest, than it does when it appears in what has been heretofore considered its most manageable forms. It could, indeed, be more easily arrested than the most simple cavities upon the grinding surfaces could be filled with gold.

If this course of treatment is commenced, and rigidly carried out until maturity, with a child seven years of age, it may with certainty be predicted:

1st. That caries of the proximate surfaces of the teeth will invariably be arrested without filling. If any exceptions occur, they will be extremely rare.

2d. That there will be no pain whatever attending the required operations.

3d. That there will be no disfiguration of the teeth.

4th. That there will be no subsequent inconvenience.

5th. That at adult age and subsequently, the dental operations required will be small in number and of the simplest character.

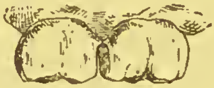
If these objects can be accomplished, no argument as to their value need be made.

But, while the course advised may be pursued with children entirely under the care of a dentist, the far greater number of cases, in general practice, will not come to his notice until the caries has passed beyond the possibility of such simple treatment.

Caries, after first appearing on the surface of the enamel, makes its way, more or less rapidly, through this substance into the dentine. But, after it reaches the dentine, as I have already explained, it may still be arrested by the simple resection of the affected part. To what extent it is advisable to push this treatment must be determined by each practitioner for himself. It is, of course, not admissible to remove so much of the teeth under treatment as to disfigure them, and the resection should not be carried so deeply as to render subsequent filling difficult without danger of exposing the pulp.

No matter to what extent the caries has progressed, if it is still within the limits of this treatment, the separation should be similar to that just described. It will be understood from the views I have just presented, that in making these separations, wedge-shaped intervals, and openings into the triangular space, are to be carefully avoided. Fig. 47 is a diagram representing the form of separation which I have found of the greatest advantage in the more advanced stages of caries. It will be seen that a bold curved shoulder toward the triangular space is left, after the separation, which will be found fully to answer the desired purpose.

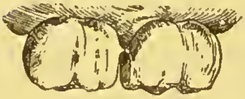
FIG. 47.



It is plain, from what has been said, that the form of the separation is a matter of the greatest importance. This is certainly the case, even with the treatment of the most superficial development of caries; it becomes much more so as it advances into the dentine. I have pointed out the radical defect of the wedge-shaped separation, and have, within the last four years, gradually changed it to the form I now employ. I have found it unexceptionable, and have no hesitation in making the strong statement that, in not a single case in which, under circumstances of average character, it has been made (and I have employed it in a great many cases), has caries again made its appearance.

Even if the caries has been allowed to advance so far that filling becomes necessary, this form of separation will be found better, as a general rule, than any yet suggested as a preparation for this operation. Although this method of preserving the teeth does not come within the scope of the present treatise, I would suggest the advantage, when the caries has not advanced too far, of bringing, by a separation of this character, the cervical portion of the cavity more fully into view (Fig. 48); as it is well known that at this point the greatest number of fillings fail.

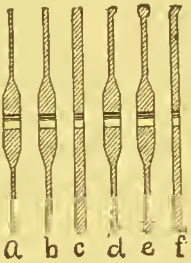
FIG. 48.



This means of making the separations described has been rendered very easy by the invention of the dental engine, with which cutting disks, of such a shape as to give the proper form to the separations required, can be used. The change in the separations advised renders necessary some changes in the forms of the disks which are at present in use. The wedge-shaped knife-edged disk I no longer consider desirable for this purpose. After very careful consideration of the whole subject, and as a result of experience, I have devised a set of disks (Fig. 49) which will, I think, be found fully to answer all the requirements for making any desirable separations. They constitute the whole set which I now find it necessary to employ.

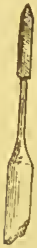
It will be seen that the peripheries of all these disks have been rounded, the knife-edges being removed. The separations described, and shown in Fig. 44, may be made by *a* or *b*, Fig. 49; the separation shown in Fig. 47, by *c*, *d*, or *e*, Fig. 49. The last three of the set, *d*, *e*, and *f*, I have found exceedingly useful in giving form to the upper part of the separation, and in removing caries after it has reached the dentine, without greatly increasing the space at the grinding surface. The entire removal of the caries from the dentine, as I have stated, is sometimes difficult, but it will be greatly facilitated by this form of disk.

FIG. 49.



The exalted sensitiveness of the dentine after it is attacked by caries renders the separation a disagreeable and, at times, a very painful operation when that part is cut with the disk. It will be found a great alleviation of the pain to make the space at the grinding surface as large as may be required before the disk is carried down to the carious point. In this way the sensitive part may be gradually approached, and, when reached, cut away rapidly.

FIG. 50.



An instrument (Fig. 50) which will occasionally be found very useful for completing the separations in the form I have described, and for many other purposes, may readily be made by any operator for himself. I have used such instruments for several years. The working end of an engine mandrel of suitable shape is roughened and heated until it will melt shellac, and is then coated with this material. Shellac is then melted on a metal plate and mixed with powdered corundum. While in a melted state a sufficient quantity for the desired purpose is taken up on the end of the mandrel, already covered with shellac, and, after cooling slightly, rolled upon a napkin or table into the desired shape. A broken disk may be employed for the purpose, although it is preferable to make the instrument with a larger proportion of corundum to the shellac. Corundum when combined with shellac will be found to cut much more freely if the instruments are occasionally placed for a short time in alcohol.